THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1620.] LONDON, MAY 29, 1894. [46TH YEAR. PRICE 6d.

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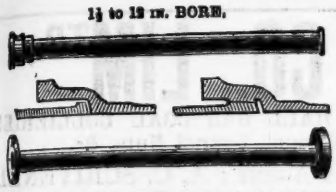

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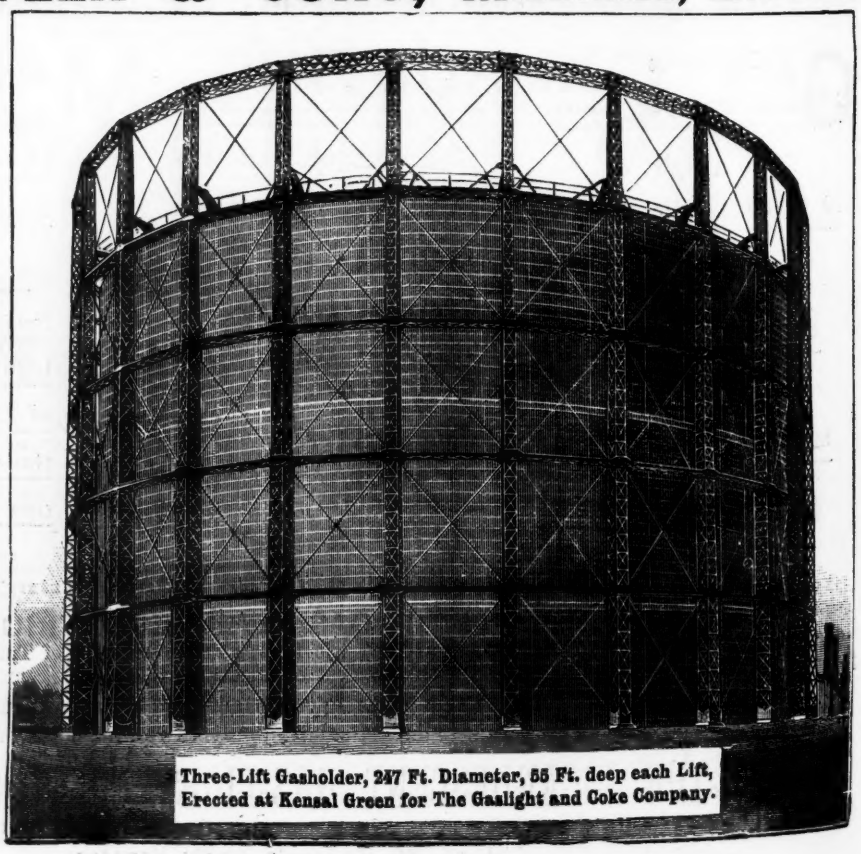

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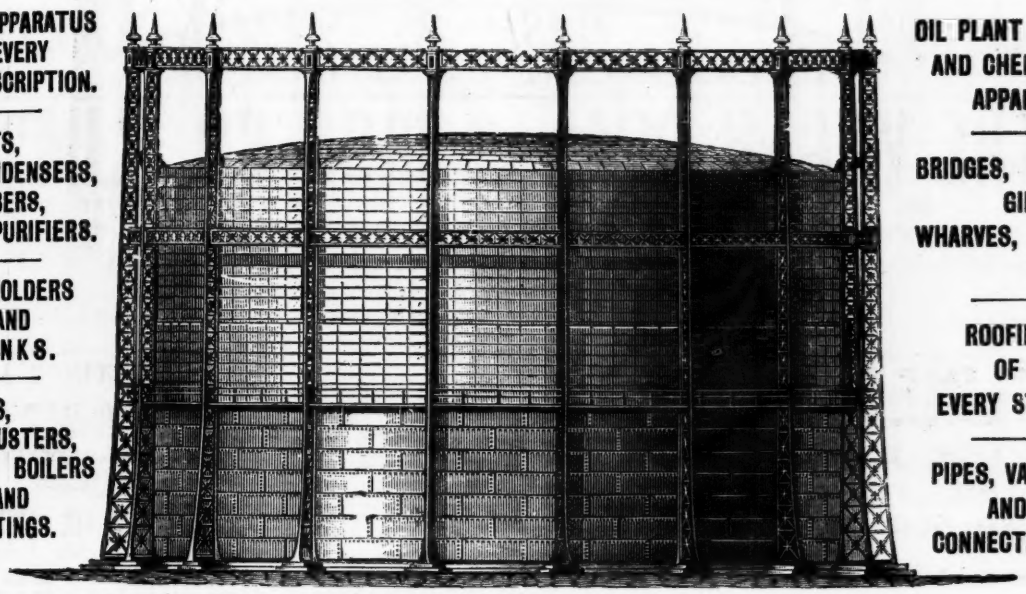

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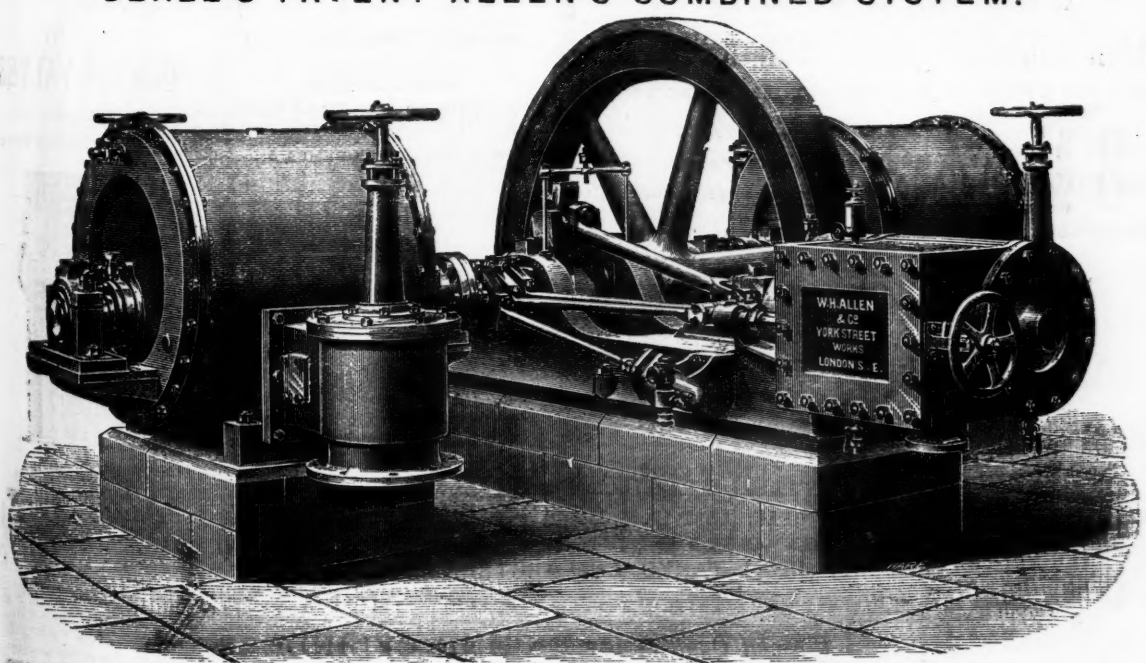

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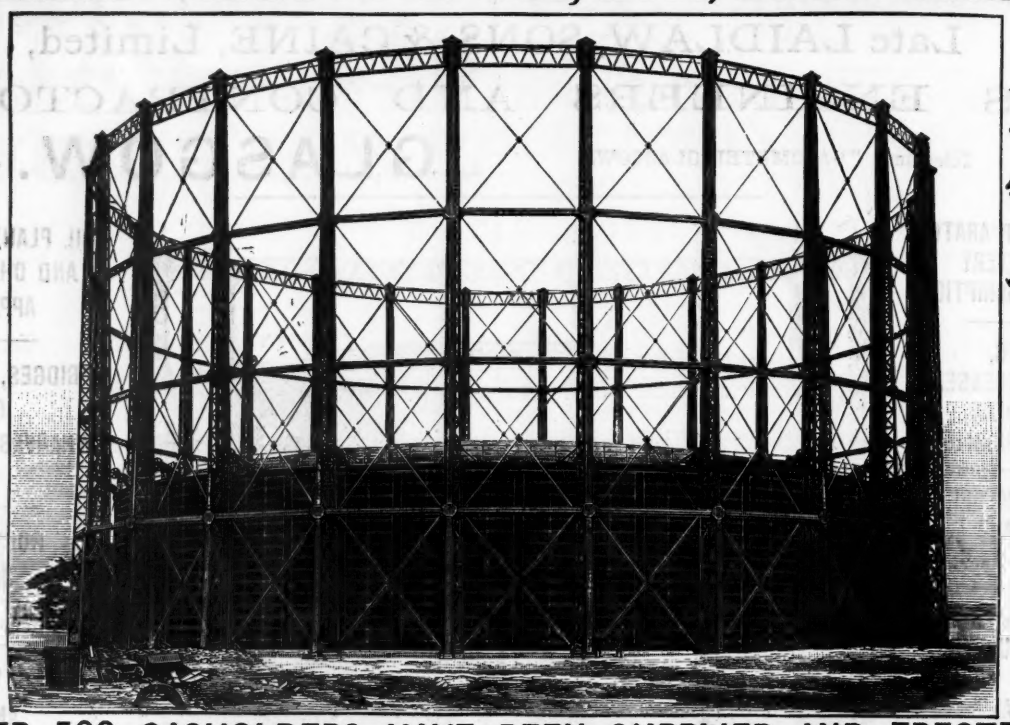

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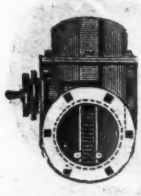

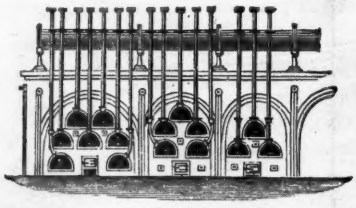

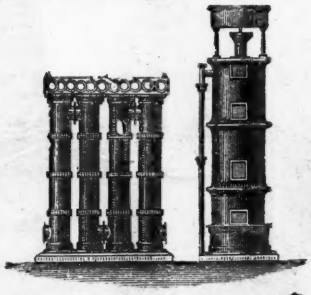

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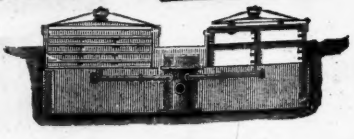

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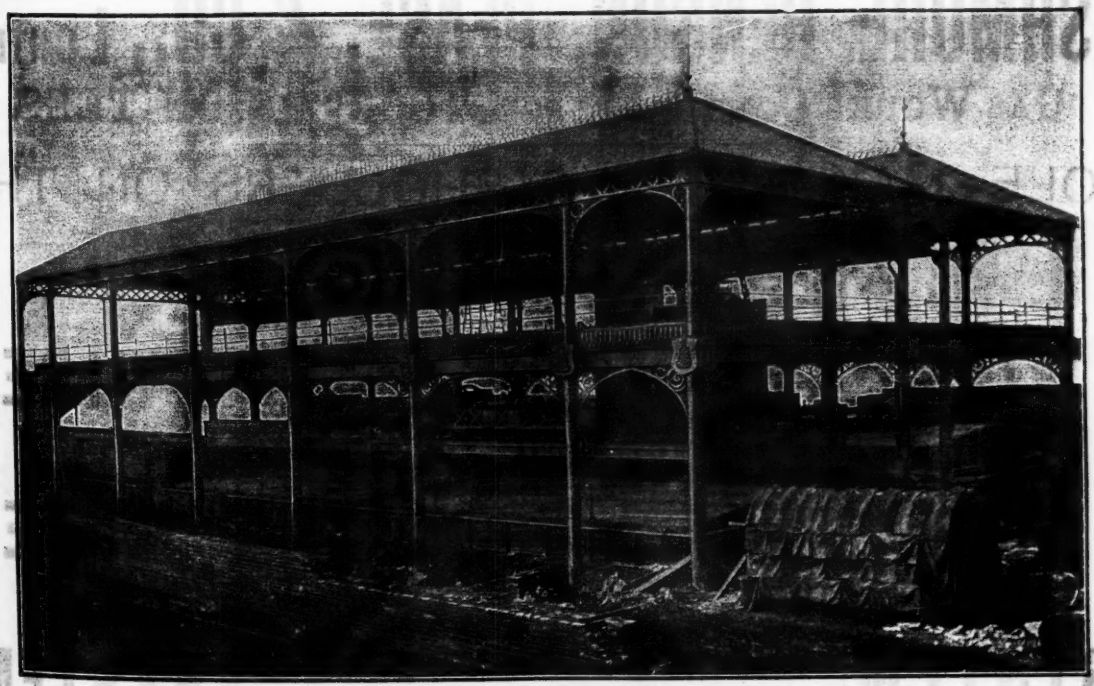

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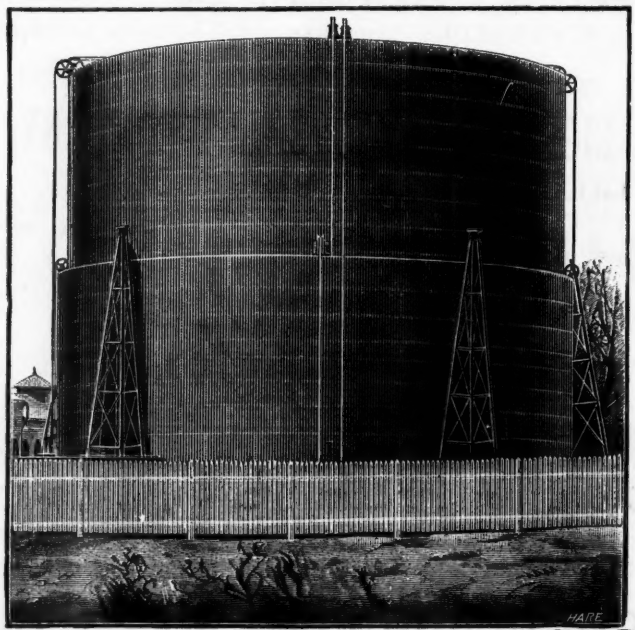

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This Engraving is taken from a Photograph of a Holder **increased in capacity from 32,000 cubic feet to 59,000 cubic feet** by the addition of a Lift. The Ropes are applied to both Lifts to supplement the Standards.

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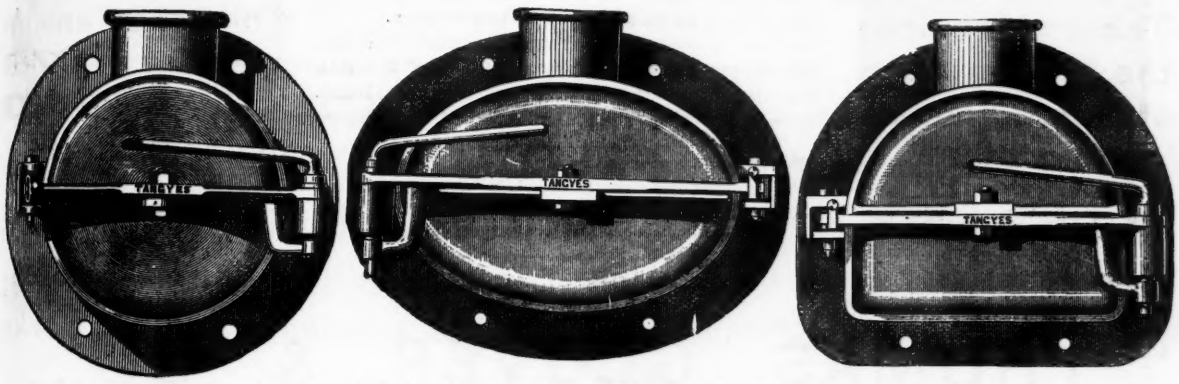
With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



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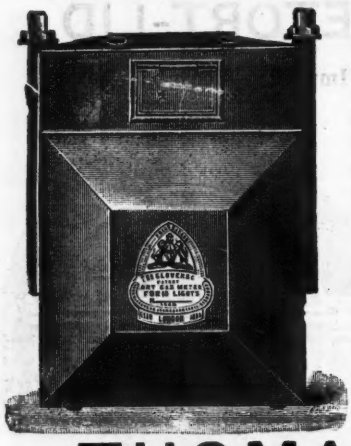

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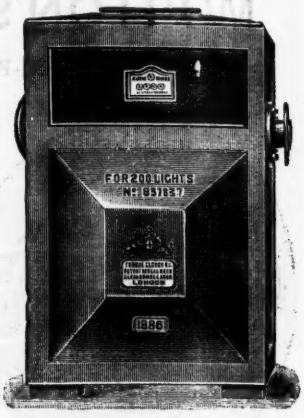
Are upheld for five years without charge.



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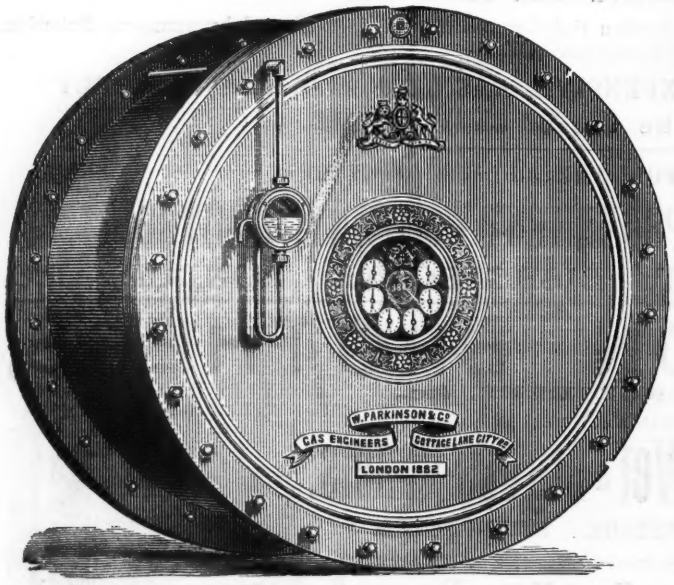

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IN
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THREE-PARTITION DRUMS.

DURABILITY UNEQUALLED. SOME HAVE BEEN IN CONSTANT USE FOR OVER 60 YEARS.

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[See also Advt., p. 1036

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 29, 1894.

Mr. Livesey on Profit-Sharing.

In his interesting and very characteristic letter which appears in another column, Mr. George Livesey complains that our comments upon his paper on profit-sharing, read at the recent meeting of the Institution of Gas Engineers, did not do him or the subject justice. At any rate, this is our interpretation of his present communication; and we are quite as anxious as he can be to put this matter right. It should not be necessary for us to assure Mr. Livesey that it was not our intention in discussing either his paper or the subject of it, to detract from the interest and value of the South Metropolitan and the Crystal Palace District Companies' experiments. As he admits, we have commented upon the whole subject before; and our opinion of his public-spirited action in the matter is unchanged. At the same time, we wished not to be carried away by the eloquence of Mr. Livesey's advocacy, or the success of the experiments under his immediate direction, and so be led to pretend to believe that the whole labour problem has been solved thereby, so far as the work of gas making is concerned. We wish we could think so, and could conscientiously call upon all gas-works administrators to go and do likewise, in the firm assurance that herein is to be found the panacea for all the industrial ills that beset them. The simple fact, however, that Mr. Livesey himself cannot at present suggest how his method is to be applied to gas undertakings under municipal ownership, and that he has not even schemed its application to non-sliding scale companies, must be our justification for calling his system a colourable imitation of the real thing—using the phrase, of course, in no invidious sense. Surely, municipal gas undertakings are carried on for profit, and certainly maximum-dividend earning works are as much so as those which come under the sliding-scale principle. If, then, a method of profit-sharing is, in truth, the "real thing," its operation should be applicable under all circumstances whenever or wherever the profit is made. That is our position with regard to Mr. Livesey's case. It may be stated, moreover, in further palliation of our view, that Mr. Giffen, in his memorandum on profit-sharing, places the South Metropolitan example, then unique, in a special category by itself. Mr. Livesey protests against our remark that his South Metropolitan experiment is not "soundly based upon a principle susceptible of general "application." There is no stress upon the word "soundly" here. The remark does not mean that the experiment is unsound—indeed, Mr. Livesey has every reason to hold to the contrary; but this statement of our opinion should be read as a complete sentence, when it will be seen that the word our correspondent objects to only applies to the point of general applicability. Then Mr. Livesey urges that there is nothing arbitrary in the selection by the Directors of the South Metropolitan and the Crystal Palace District Companies of the starting point for their profit-sharing sliding-scale. Well, the question is merely one of the interpretation of the word. It is quite true that people have to select points for departure in many of the affairs of life; but it is frequently still possible to describe such datum-lines as arbitrarily selected, even though they are found to answer well in practice. In the cases in question, somebody makes the suggestion of a starting-point, and others fall in with it. We are under the impression that Mr. Livesey himself has somewhere described this process as an arbitrary selection; but if the term sounds hard, let it be called a tentative suggestion, or anything else that eliminates the idea of arbitrariness, which is what we understand Mr. Livesey to repudiate, and which we never intended to allege in this connection. Lastly, we agree heartily with the conclusion of Mr. Livesey's letter.

The Birmingham Gas Committee and the Council.

As Chairman of the Gas Committee of the Birmingham City Council, Mr. Alderman Pollack had a rather onerous duty to discharge this day week, when, at the special meeting of the Council called for the purpose, he moved the approval of the report and accounts of the Committee which we published and discussed in the last issue of the JOURNAL. He pointed out that the three most important features of the past year's working of the undertaking were the coal strike, the decreased consumption of gas, and the increased selling price. The consequences of the first-named influence upon the undertaking would have been more serious if the Committee had not promptly resold their emergency purchases of coal as soon as the strike ended, and the ordinary contractors resumed deliveries. Alderman Pollack had to go at length into the subject of the diminished output of gas for the year, which he took at 2 per cent.; and he proceeded to discuss in a calm and judicial manner the reasons for the result. Like other places, Birmingham had an extraordinary allowance of sunshine last year, which enabled many workshops and offices in the city to dispense with gas. By considering the consumption in the different wards, the Gas Committee

have been able to ascertain that in the central region, where the Electric Lighting Company are firmly established, the demand for gas has suffered. On the other hand, in the outlying districts, gas continues to increase in favour. The fact that the trade of Birmingham has not been good of late also affects the gas undertaking unfavourably; and, it may be added, every penny per 1000 cubic feet of increased price damages the popularity of gas. On the whole, answering for himself the question as to whether the decreased consumption may be regarded as due to temporary or to permanent influences, Alderman Pollack inclines to the opinion that, while the sale of gas within the city limits is not likely to continue to increase after the same rate as the growth during the past eighteen years, there will still be a "gradual though slower in-"crease, mainly governed by better trade." This will also be governed, although the Alderman did not say so, by the selling price. He was questioned upon this point by other members of the Council; and he declared that the increased price will not be maintained by the Committee for a day longer than is absolutely necessary. This is obviously true; for the Committee must be fully aware of the disadvantage at which the present price makes them appear. There seems to be an unusual amount of local discontent with the proceedings of the Committee, which is not allayed by the discovery that, after having secured permission to advance the price of gas by 3d. per 1000 cubic feet in order to provide against an estimated loss of £24,000 through the coal strike, this increase is kept on, though the loss has not amounted to more than £15,000, and the Gas Department have done very much better than was expected with their residuals. There have been many letters in the newspapers alleging overcharging of consumers and other malpractices against the officials of the department, which are obviously nonsensical; but these are no more than the customary indications of popular dissatisfaction with the cost of gas lighting, which can generally be removed by the mere announcement that gas is going to be cheaper.

Trade Union Tyranny.

A SERIES of articles upon the "Tyranny of Trade "Unionism" appeared last week in the *Globe*, which gave a number of striking instances of interference by Trades Unions with the liberty of the subject. The salient lesson of all these disclosures is well expressed by the writer as being the indication they afford of the nature of the ruling principle of Trade Unionism, which is the restriction of every man's earnings to the bare "living wage," and the reduction of effort to one dead level. It is remarkable that while the sympathies of the public have been bespoken for the efforts of one order of workers—viz., the coal miners—to ensure that their industry shall never fall below the standard which has been defined as the "living wage," the organized workers in other trades have committed themselves to a system which denies to its supporters the prospect of rising above the same standard. Yet that this is the essence of Trade Unionism is manifested by the character of the rules by which the majority of trade societies are governed. These strike directly at the thrifty, energetic workman, whom an employer would naturally like to encourage. Examples of this kind of control are to be found in such restrictions as that of the London printers against men working at more than one establishment, and those of some other societies forbidding men engaged in one branch of a trade from doing work in another. Several Unions are administered in this spirit of exclusiveness, which has the effect of keeping men in one groove, and entirely under the domination of the officials. A system of mutual espionage is practised in some Unions, and expressed by means of fines. It might be argued that one result of the triumph of Trade Unionism in the land would be the creation of a number of castes as strongly fenced off from one another, and as inimical to progress in the arts and manufactures, as those of Hindustan. As it is, the free worker is to the strict society man as a pariah, whom to touch is defilement, and to help in time of need criminal. It matters not if the free worker is a better man, and earning more money, than the strict and particular unionist, or if he is a poor old human wreck not equal to the standard of working recognized as "the Union stroke." In either case he is an outcast, regarded as a fit object for the traditional "half brick" when nobody is looking. The Unions constitute themseves judges in their own cause; dubbing an employer "unfair" whether he allows the men in his establishment to earn as much money as they can or as little as they are worth. "The etiquette of "Trade Unionism is the same throughout the country. "Members are expected to be blind to their individual "interests, and out of sympathy with everyone else." And the slightest infraction of the rules of the Societies—which, voluminous and minute as they often are, in many cases are supplemented by a number of unwritten points of Society etiquette—subjects the transgressor to fine, and perhaps] expulsion. The men who wield this tremendous power over their fellows—ignorant, self-seeking demagogues as they sometimes are—scarcely pretend to be subject to the restraints of the law of the land when they speak or act in the name of Trade Unionism. It is a curious sign of the times that this tyranny should have arisen and should flourish in a country which boasts that all its citizens are free men, and in a state of civilization supposed to be the product of the intelligent use made of this freedom by law-abiding men.

The Proposed New Factory Act.

THE Government Bill for the amendment of the law relating to factories and workshops has been printed. It applies mainly to establishments of descriptions with which we are not particularly concerned; but there are details of the proposed legislation which may be interpreted as applying to gas-works as well as to factories of every conceivable kind. A clause of the Bill relating to accidents proposes, among other things, that an inquiry must be held whenever any person employed in a factory is so injured as to be prevented from doing five hours' work on any one of the three days next after the occurrence of the accident. Certain provisions of the Factory Acts with respect to the fencing of machinery, notice of accidents, and the powers of inspectors, are to be made applicable to "every dock, wharf, quay, or warehouse, and any pre-"mises on which machinery is temporarily used for the "purpose of the construction of a building or any struc-"tural work in connection with a building." Is a gas-holder a "building" in accordance with the terms of the Bill? In all probability it is, or else it is to be regarded as "premises" in the language of the draft. If the Bill becomes law, there will be no avoiding the general sweep of its provisions; and all employers of labour who are unfortunate enough to have an accident, even if the catastrophe occurs in connection with a job of main laying, had better err on the right side, and put themselves in communication with the Board of Trade forthwith, for we are getting so thoroughly governed now-a-days that it is difficult to say when it may or may not be necessary to call in an Inspector.

The Inspection of Gas-Works under the Alkali Act.—A Caution to Gas Managers.

A PROSECUTION has been recently instituted by the Chief Inspector under the Alkali, &c., Works Regulation Act for the recovery of a penalty for an offence committed against the provisions of the Act. The offence in question was peculiar; and no precisely similar case has hitherto occurred. It consisted of deception on the part of the Manager of the works as to the treatment of the sulphuretted hydrogen evolved in the manufacture of sulphate of ammonia. Most of our readers are aware that this manufacture must be carried on with the entire absorption, or otherwise effective treatment, of the sulphuretted hydrogen evolved, so as to prevent danger or nuisance. Absorption of the gas in oxide of iron purifiers is one of the most popular and approved methods in use for its treatment. In the case in question, the Government Inspector was led to believe that the foul gases were being passed to, and treated in, two oxide of iron purifiers which had been provided for the purpose. These purifiers were maintained in an apparently satisfactory and efficient condition; but an underground bye-pass pipe existed, unknown to the Inspector, which conveyed the sulphuretted hydrogen to the retort-house chimney—thus misleading him as to the mode of treating the gases, and as to the position of their ultimate outlet into the atmosphere. The Act does not contain any clause providing distinctly for cases of such deception on the part of an owner or manager of a works registered under the Act; but proceedings were taken under clause 17, which specifies that "the "owner of every work and his agents shall render to every

"inspector all necessary facilities for an entry, inspection, "examination, and testing, in pursuance," &c. By misleading the Inspector as to the point of delivery of the gases into the atmosphere, he was prevented from having that control over the outlet which the law requires; and hence the action. The offence complained of also consisted in sprinkling fresh oxide of iron on the surface of the purifiers as soon as the presence of the Inspector in the works was known. The action was stopped from coming to a hearing by the full penalty claimed being paid into Court, with costs. We give this bare outline of the case, as, had it come to a hearing, it doubtless would have offered many interesting points during argument. It may also be useful in deterring any others who might be disposed to act similarly.

The Gas Supply of Chicago.

THE methods by which gas is supplied to United States cities have just received some little further illumination by the announcement of the Attorney-General of Illinois that he is about to commence a suit for the forfeiture of the Charters of the Companies composing the Chicago Gas Trust, on the ground that, by entering into this combination, they have violated the Anti-Trust law of the State. The gas supply of Chicago, as of most other cities in the States, is intermittently in a condition of either "combine" or competition. Whenever a new gas company can get a chance of "chipping in," it does so; and for a season there is war between the new men and the old. Then the inevitable happens; and the newcomers, having testified to their earnestness, are taken into the ring, and receive their share of the plunder of the consumers. Of course, this sort of thing is strictly forbidden by the laws of the State of Illinois, which do not tolerate anything of the nature of a commercial "Trust" whereby the benefits of trade competition are denied to the people; and, equally of course, the prohibition is wholly disregarded by those interested in working a "combine" that promises to pay them. The Chicago Gas Trust has been in full swing for some time under this name, in the capital city of the State which professes to hold such arrangements illegal; but at length Nemesis has awakened, and the Trust is threatened with exposure. The best of the affair is that the slumberous State law has been put in motion, not by a member of the defrauded public, but at the instigation of a man with a rival gas process, who hopes to get up yet another Gas Company for Chicago, in revenge for having been slighted by the present incumbents. The reasons given by the Illinois Attorney-General for his intended action are instructive. He finds that the corporations involved belong to a Trust having practically a common Board of Directors. Nearly all the capital, amounting to close on $15,000,000 is held by the Fidelity Trust Company of Philadelphia, to whom the amount of all the dividends earned by the several corporations, although declared in Chicago separately, are forwarded in a lump sum, to be divided between the certificate holders of the Philadelphia Company, just as if the money came from one source. Some of these Companies are not manufacturing gas, but are held idle by the Trust while their mains are used for the distribution of gas produced by other Companies. Gas is further stated to be sold to different Companies at various prices whenever it is thought desirable, in the interest of the combination, to show one of the Companies in an exceptionally favourable light. The Attorney-General wishes it to be understood that he is taking action in the matter upon his own responsibility; and the question now being asked in the city is what the result is likely to be, supposing that the Law Officer proves his case. The answer is "a receiver-"ship, followed by a reorganization of some sort;" and the last state of the victimized gas consumers would, in all probability, be worse than the first. Gas supply in the United States appears to be a very engrossing game, and must be a paying one for those who know the rules, and are not overburdened with scruples. It is a game, however, that is best watched from a safe distance, like that celebrated game of euchre which induced the philosophic spectator to ask himself whether indeed civilization is not a failure, and the Caucasian "played out." It does not say much for the intelligence of the great American public that they permit themselves to be bled by any number of gas "raiders" who care to go into this easy and profitable business.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, MAY 9 & 10, 1894.

Mr. ALFRED COLSON, M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

We continue to-day our report of the technical portion of the proceedings at the above meeting by giving the discussion on the papers by Mr. Frank Livesey and Mr. Tysoe (published in the last number of the JOURNAL), and the first of the group of enrichment papers—that by Mr. J. Ferguson Bell, of Stafford.

DISCUSSION ON MR. FRANK LIVESEY'S PAPER ON "STOKING MACHINERY OR INCLINED RETORTS."

The PRESIDENT said no more important question was exercising the minds of gas engineers at the present day than that of stoking machinery and inclined retorts; and the papers before the meeting were valuable contributions to the subject.

Mr. CHARLES HUNT (Birmingham) said this question had engaged his attention for a considerable time, and he hoped to have treated upon it himself; but he was glad that it had been undertaken by abler hands. He could not find any fault with the comparison Mr. Livesey had made between the inclined retort system and that of stoking by machinery, except, perhaps, as to his estimate of the cost of applying inclined retorts. He had tried, during the reading of the paper, to work out the cost of the installation at Birmingham; and he could not make it so high as was mentioned by the author. This, however, was a small matter as compared with the principle of working. The inclined retort system possessed immense attractions, from the facility with which a retort might be charged without practically any manual labour, and from the fact that success depended entirely upon the observance of the conditions which were essentials of good carbonization—viz., the proper heating of the retorts, and the even distribution of the coal within them. He never attached much importance to the objection that the gas made must necessarily be of lower quality because it came into contact with a large area of heated surface; and he was glad to hear from Mr. Livesey that his experiments proved that this objection had no foundation. The difficulty he had experienced was that the conditions which were suitable for one size of coal were unsuitable when the coal varied in size. Their retorts had to be set at an angle of 29°; and they found that with nuts very good charges were made of full weight and evenly distributed. But when the supply of nuts failed, and they had to fall back upon any coal that could be obtained, the retorts were sometimes only half charged, and generally very badly indeed. With dusty coal, they could not charge the retorts. He was informed that in other places, where the retorts were set at a greater angle, this difficulty had been overcome by a little manipulation on the part of the workmen; but in his case this was not practicable. On the other hand, machinery possessed the great advantage that any kind of coal could be used with equal facility, provided the large lumps were broken, and, moreover, both charging and drawing were done with little or no strain on the workman, who was also removed from the heat. This was a most favourable feature of machinery compared with the inclined retort system. As far as he had observed, the heat to which the men were exposed in drawing the latter was considerable; and he had come to the conclusion that in this respect the inclined retort system was a retrograde movement. What they were aiming at was to improve the facilities by which the work was done, so as not only to reduce the cost, but to lessen the toil and exposure of the workmen; and the reverse of this was effected by the inclined retort system as compared with machinery. He had had the two systems

working side by side in the same retort-house, and so far he was in favour of machinery.

Mr. G. E. Stevenson (Manchester) said no doubt the advantage which Mr. Livesey had mentioned in favour of stoking machinery, and which had been supported by Mr. Hunt—viz., that machinery could deal with any quality of coal—was a great point; but he could not help feeling that, both in the paper and in Mr. Hunt's remarks, inclined retorts had hardly had full justice done to them, although he had not had as much experience as either of those gentlemen. In the first place, he could not see that the comparison of cost was quite correct. It struck him that £52, which Mr. Livesey had put down for a 20-feet horizontal retort, was very low. He had never been able to erect a retort-setting with regenerator furnaces at such a cost; and they ought to include such a system of heating because the inclined retorts certainly required it. He did not find that he could put up a regenerator setting for nine through retorts—including all ironwork, the bench stack, arches, and the stage-floor—for less than £42 to £44 per mouthpiece, which would be nearer £90 than £52 per retort. Regarding inclined retorts, he only knew what it cost to put up a small installation; and this worked out to about £80. But it was of lighter construction than such as he had referred to as costing from £40 to £45 per mouthpiece. With a larger installation, he should imagine the cost might be reduced to £70 or £75, and at the same time be constructed in a more substantial manner. He quite believed that inclined settings cost more to build than horizontal ones; but he did not think the difference was so great as had been stated. Another point on which he thought the author was hardly fair to the inclined retorts was in the cost of carbonizing. Taking the figures as to the number of mouthpieces which could be charged with machinery in a day, they exactly corresponded with what was being done at the present time at the Bradford Road station, Manchester, with machinery of the most modern kind—viz., 900 mouthpieces in 24 hours. But there the cost came out at 1s. 9d., not 1s. 6d., per ton for the whole of the expenses in the retort-house. This was the lowest cost he had seen it done for hitherto by machinery. At Rochdale Road, they could not do it under 2s.; and only under very favourable circumstances as low as that. On the other hand, inclined retorts could be worked at 1s. 6d., even in a small installation. What could be done with a larger one remained to be seen. Some of them had large batteries of retorts worked by machinery; but hitherto there was no large installation of inclined retorts which had been constantly worked for a long period. All these points should be taken into consideration in comparing the two systems.

Mr. T. B. Ball (Rochdale) said he had had some little experience of inclined retorts, and was now engaged in erecting a new house, and putting in twenty settings; but he had not had any experience with machinery. Though, as far as it went, the comparison with stoking machinery might be perfectly accurate, his sympathies were with Mr. Stevenson with regard to the figures. It must also be borne in mind that stoking machinery was not available in all places where inclined retorts would be. He did not know whether Mr. Livesey included in the cost of inclined retorts that of the elevating and conveying machinery to supply them. [Mr. Livesey said he did.] For those they were putting up now, the cost would come out below the figure given. Their experience had been that any difficulty there was was rather with the drawing than with the charging, though, like everyone else during the past year, their experience of coals had been somewhat varied. Their retorts were set at about 31°; and when dealing with Durham coal, they had some trouble in adjusting the charges. On the whole, however, there was very little reason to be dissatisfied on that score. As to the bulk of gas produced, his experience was the same as Mr. Livesey's—that the quantity was quite up to that from horizontal retorts, although he had only a small installation of five settings. In the case of machinery, Mr. Livesey compared the cost with settings of ten in a bed, in five tiers; and he should not like to contemplate the result of the machinery breaking down in an ordinary-sized works, involving the stoppage (say) of half a day, and having to find the necessary men to work those settings during the stoppage. He mentioned 75 retorts every two hours as the allotted work for each machine; the time actually occupied being an hour and a quarter. This gave a maximum interval between the charges of about three-quarters of an hour. The time for repairs was, therefore, very limited; and if the retorts were kept going at that speed for the whole week, he should think there would be a great possibility of part of the works being laid idle occasionally. Of course, this was only conjecture. He thought the inclined retort system for moderate-sized works, where machinery could not be economically applied during the greater part of the year, possessed advantages not mentioned in the comparison Mr. Livesey had instituted.

Mr. J. F. Braidwood (Greenwich) said they had been working inclined retorts for the past three years, and were perfectly satisfied with them. They improved them with each installation. He did not find the difficulty of which Mr. Hunt had complained; and he thought, if sufficient attention were paid to the angle when they were being erected, in order to have a reserve of angle at their disposal to allow the coal to go faster or slower by an automatic arrangement, it was everything that could be wished. He should be very sorry indeed to go back to the horizontal system. The improvement in the retort-house was quite remarkable. The place seemed almost deserted, and perfectly quiet; whereas if one went into a retort-house where machinery was in operation, it was like going into an engineer's shop where a big hammer was at work. Judging from the rattle of the machinery going on, it struck him that there must be very heavy wear and tear indeed; and if there was a breakdown, he wondered what would become of the work for the time being. There might be three or four hours' stoppage, or even more; and they would have to go round and get men, perhaps in the middle of the night, to keep it going. There was no machinery whatever with inclined retorts—simply an ordinary elevator to the height required. He therefore thought that, for medium-sized retort-houses, machinery could not compare at all with the other system. Machinery was almost as expensive as hand labour, unless one had 2 million cubic feet of gas per day, or more, to make; and it was not all works which wanted to produce so much as that. For smaller works, it would not do. With inclined retorts, one could work 300 tons of coal per week as economically as 1000 tons.

Mr. W. R. Herring (Huddersfield) said Mr. Livesey's paper was of considerable interest to him, as he had only recently had to decide for himself the question dealt with therein. As many gentlemen present knew, they had at Huddersfield a large installation of inclined retorts, which they got to work about August last, and during the past winter they worked the whole of them. In speaking of the inclined retort system, it was as well to state exactly the method of charging adopted, because there were many modifications; and some methods of charging possessed no advantages whatever. He would briefly describe the plant at Huddersfield. It was a continuous hopper for coal storeage at the top, with measuring chambers beneath. There was an arrangement in each chamber by which the charge could be regulated to the extent of about 30 per cent.; and he recently added a balanced flap or check-plate, called "Graham's patent check-feed," by means of which it was impossible for the men to put into the retort any other weight than the contents of the hopper, to whatever it was adjusted. None of the coal left the measuring chamber until the lever was pulled full open, with the top valve consequently shut, which prevented the bye-passing of any coal from the storeage hopper into the measuring chamber after it had begun to discharge its contents into the shoot; nor could the lever be again brought back until the whole of the contents of the chamber had been discharged. This appeared to him to be the connecting-link in the process of taking the carbonizing system entirely out of the hands of the workmen. They must either give the retort its proper charge, or leave it empty. This retort-house was a ground-floor one; and consequently they worked at a disadvantage with regard to the bottom retorts. There were twenty settings of nine retorts, each 15 feet long, and the three bottom ones consequently had to discharge on the ground-floor of the house. Notwithstanding this, the carbonizing wages were 1s. 6d. per ton, including the elevating of both coal and coke. The furnaces were on the charging side; and the coke had to be wheeled from a storeage hopper at one end, into which it was elevated. In the new retort-house now being erected, they would have a stage-floor, so that the whole of the coke would be dis-

charged below the stage; and on the level of the general yard; and he hoped they would be able to dispose of most of the coke from the basement. If they had to wheel it, they could stack it practically at a level of 10 feet high, to commence with, by having openings in the wall at the drawing-stage level. In the course of his paper, Mr. Livesey made a remark with regard to the area of space occupied per ton of coal, and said that horizontal work could be done at 46 superficial feet per ton. He then instanced a setting of retorts which was not generally acknowledged to be the best. The installation at the Huddersfield works covered 50 feet per ton; but he could give two instances where the ground area of a retort-house structure was saved in this respect. In the present installation, they had a retort-house with the chimney in the middle. At one end there were nine settings of eight through 20-feet retorts. They had room, however, for ten settings; so that there could be ten settings of nines. On the other half there were twenty settings of nine retorts 15 feet long; so that they had a gain there of something like 50 per cent. in the producing power of that house. If in the new house now being built, which was 87 feet wide, horizontal retorts were adopted, they could get a bench consisting of thirty settings of nines, which would represent 5400 lineal feet of horizontal retort. By adopting the inclined retort system on the same area, they could get 8100 lineal feet of carbonizing surface. Supposing they decided to build horizontal settings, he did not think, after allowing for working room, coal-store room, and so on, the width could have been reduced much, if anything. In this respect there was a distinct gain, apart from the working cost. With regard to machinery, the question had been raised as to how many retorts were required to work a machine economically. Mr. Livesey had given 900 mouthpieces in 24 hours. But there were not many establishments on so large a scale as that; and on this ground also the inclined retort system possessed decided advantages for the majority of works. There were practically no moving parts. What machinery there was, was only working nine or ten hours a day. None was going through the night; and the working parts were as few as possible. He was therefore forced to the conclusion that the inclined retort system possessed advantages over machinery. He thought they would, with sundry little improvements, be able to work at 1s. 4d. per ton easily. They were now doing it at Huddersfield at half the cost of the horizontal retorts.

Mr. J. West (Manchester) said that he had been much interested to hear the opinions of gentlemen, especially the reader of the paper and Mr. Hunt, who had had large experience in the working of both systems. He had no prejudices himself one way or the other, as they both required a large amount of machinery, and therefore both were advantageous to him. Some two or three years ago when in Scotland, he said it was well that everything should have a trial. But there were a few questions which required settling; and he thought some of them would have been settled that day. The last two speakers, however, did not seem to think so. The first question was the cost of installations. To a great many minds, this had been satisfactorily settled; and he was strongly of opinion that the first cost per mouthpiece must be much more with inclined retorts than with the horizontal system. But when one engineer began to compare the cost at his works with that at another place, he knew it was very difficult to arrive at the truth, as there was a very great difference in the stability with which different engineers carried out the work; and the cost of materials varied very considerably in different districts. Mr. Stevenson spoke of the cost of a horizontal system in a house he recently remodelled, and compared it with what he thought he could do with the inclined retort system; but he (Mr. West) was of opinion that, if he put up the work on the inclined system in the same stable manner as he had the horizontal system, he would be mistaken in his figures. Another point was the illuminating power; and he was not certain that this was yet satisfactorily settled. Mr. Livesey said that they had made experiments for a fortnight; but he qualified his remarks by saying that there might have been a change in the coal. This question of illuminating power was really most important in the London district, where they were in difficulty about 1½ candles, and discussing whether or not they should use cannel. It was a question which ought to be settled. They had been going on for three or four years; and it would be well if some gentlemen in large works would take the trouble to investigate it, testing both systems with the same kind of coal, so as to have something definite both with regard to volume, wear and tear, illuminating power, &c. The fuel account had not been mentioned; and it had not been proved yet which system had the advantage. It was the same with regard to wear and tear. There had been hardly sufficient time yet to settle this. The cost of wages was another very important question. Mr. Livesey gave the number of men, and included the foreman, the exhauster man, the boiler man, and the coal wheelers, some of which items were not always included in carbonizing wages. There were a variety of ways of ascertaining the carbonizing wages. Some added the coal, and others left it out; and the same was the case with the wheeling of coke. In all cases of comparison, the exact details should be given. With regard to the reliability and durability of machinery, he thought Mr. Ball need not fear when Mr. Livesey told them they had had machinery at work at the East Greenwich station for three years with only one month's intermission. This showed that they were not much afraid of a breakdown; and any little thing that did go wrong was soon put right. There was a slight noise with one class of machine; but with other classes, using compressed air or hydraulic power, there could be no objection on this score. The principal question for them, as commercial men, was which was the best to use; and he had hoped they would have had rather more definite figures with regard to the inclined retort system. There seemed nothing very definite about it on an extensive scale; but the time had come when trials on such a scale should be made. Even some of the important companies were still undecided, perhaps because in large works they could only find time to make experiments in the summer. Great credit was due to those gentlemen who had put up these installations, because, until they were tried, no conclusion could be come to. It was high time, however, that more satisfactory statements should be rendered; and he thought it was one of the subjects which the Institution of Gas Engineers, and also The Gas Institute, should take up, and funds should be found for the scientific testing of these important questions, in order to avoid the waste of large sums of money.

Mr. J. Tysoe (East Greenwich) said he could confirm the figures presented by Mr. Livesey as to the cost of horizontal retorts. He believed they were arrived at in connection with the retorts erected at East Greenwich under his supervision; and he might say that they were absolutely correct. The cost per retort of that setting of tens was £52; but, of course, they were erected more economically than smaller settings. With regard to the cost of inclined retorts, he had no knowledge personally. He had taken published statements, and found that the lowest estimate amounted to 50 per cent. more than the expense of the horizontal retorts at East Greenwich. Deducting the cost of 225 horizontal retorts from that of the same number on the inclined system, the difference would amount to a sum more than sufficient to purchase the most expensive stoking machinery; and if it could be shown that the expense of carbonizing was equal, the matter was proved at once—viz., that machinery was the better system of the two. As to interruptions in working the machines, he might say that at East Greenwich they had been at work 1220 days with about one month's intermission for repairs. This was a very good record. They had occasionally slight breakdowns. But where facilities existed on the works for dealing with them, as should be the case, they were soon remedied; and they had no apprehension whatever if the machines were properly attended to. They must be looked after every day, not once a week. It was only a matter of a few minutes for the foreman to go round, and if there was a sign of anything going wrong, to have it repaired at once. This was the system rigidly carried out in their works; and they had no fear of a breakdown.

Mr. Stevenson said he should not like it to be supposed that he doubted Mr. Livesey's figures. He only questioned their comparative application.

Mr. J. Methven (Beckton) said that he had not had any experience which would enable him to make any comments on the paper with respect to the comparative merits of the two systems of stoking referred to therein. He had, however, had considerable experience of retort-stoking

by machinery; and the conclusion he had arrived at was that the work could be satisfactorily done at a cost of about half that of hand labour. He also knew something of the wear and tear of machines, which was not an unimportant item—in fact, it was a very heavy one. Notwithstanding this, they had some excellent work executed by machinery; and he thought altogether it was a very satisfactory method of carbonizing coal. His desire all along had been to remove from the stoker the laborious nature of his duties. If they could succeed in doing work by machinery, and so lighten the toil of the hard-worked and ill-used stoker, they would be conferring a benefit upon him. Mr. Livesey had alluded to the gas being of a lower quality from the inclined retorts, which he regarded as being due to having only one ascension-pipe. But he (Mr. Methven) did not think this was exactly correct. There were in London several works in which horizontal retorts were operated with only one ascension-pipe—notably one at Fulham, which had only one ascension-pipe from a long retort; and that station was able to fully comply with the statutory requirements for London gas, carbonizing ordinary Durham coal without any cannel at all. This might not be due to having only one ascension-pipe, but to the circumstance that there was no hydraulic main—valves being used for closing it every time the retort was opened. Nevertheless, there was the fact established that this and other stations in London were working long retorts with only one ascension-pipe. He had done it for years at the Nine Elms station, and had not found any inconvenience in that respect, working through a liquor seal in the hydraulic main. He thought the loss of illuminating power in the inclined retorts was due to the whole of the gas, when there was only one ascension-pipe, having to travel downwards against the heated walls of the retort. It was the contrary direction to that in which the gas had a tendency to flow; and it created friction against the hot walls, which acted prejudicially on the illuminating power. He was a little disappointed, because he had looked forward to getting some very definite idea as to the relative advantages of the two systems dealt with in the paper; and he expected that Mr. Hunt would have given them the result of his valuable experience. He had stated that he preferred horizontal retorts; but he (Mr. Methven) was sorry he could not furnish them with more figures and statistics as to the illuminating power of the gas produced. He had little doubt that, with ordinary coal, suitable for use in the inclined retort system, the volume of gas could be got out; but he was very doubtful whether one could get the quality. Reverting to machine-charged retorts, he might say that where there was a large house, as at Beckton, which was very well served by West's machines, they noticed that the quality of the gas was slightly lower than that produced in the hand-charged retort-houses alongside of it. He attributed this to the fact that the draws were executed every two hours; and before the machines could get from one end of the house to the other and complete the draw, the time occupied was about an hour. He believed it was owing to this that they had irregularities in the quality of the gas.

Mr. Hunt said he also might express his surprise that Mr. Methven, who certainly was one of the first to introduce the inclined retort system, was not able to give details of his experience.

Mr. Methven said he had intended to explain that matter. He had the satisfaction, or dissatisfaction, of being one of the pioneers of the inclined retort movement; but, unfortunately, they put up an installation of a primitive kind, and, as far as his experience went, it had been very unsatisfactory. He did not, however, wish on that ground to condemn the system.

Mr. C. C. Carpenter (Vauxhall) desired to make just one remark with reference to settings of tens. It seemed to him, judging from the direction the discussion had taken, that the advocates of inclined retorts had looked upon the possibility of getting a setting of ten on the same ground space as one of six as their most serious competitor. He had had experience with settings of various numbers, from five upwards; and he must say that, though he had at first some doubt whether equally good results could be obtained from tens as from sixes, he found a setting of ten was by far the most economical. The question had been asked on the previous day: Why stop at eights? But he would go farther, and say: Why stop at tens? He looked forward to not only going another tier, but perhaps one or two tiers higher still. He thought there was no reason in the world, from a structural point of view, or for getting the greatest duty out of the retorts, why they should not go to six or seven tiers, or twelve or fourteen retorts in these tall settings, without any difficulty whatever.

Mr. F. Livesey said he was sorry he could not have had the benefit of the discussion before writing the paper, as then possibly he might have written a better one. He had tried to approach the question with a perfectly unbiassed mind. But he had a tendency to take the weaker side; and when he found the power system was the best, he rather did what he could for the inclined retorts. He believed the patentees considered the best way to work was to have a continuous hopper along the front of the bench, because it reduced the daily wages, though it rather increased the capital expenditure. With regard to the workmen, there was no doubt which was the better plan; for with machinery the stoker could work the whole shift straight off, though it would not be right to ask him to do so. There was certainly not so much mental effort required in working a stoking-machine as there was in working a steam-crane lifting coal out of a barge. Mr. Stevenson had alluded to the small cost allowed for horizontal retorts; and he (Mr. Livesey) judged from his remarks that he considered the setting a cheap, but not a good one. There he differed from him entirely. The setting of tens was first of all introduced into London at the St. Pancras station, and was afterwards copied by the Surrey Consumers' Gas Company at Rotherhithe; after which he introduced it at East Greenwich and Old Kent Road. Then Mr. Carpenter took it up at Vauxhall. He was thoroughly satisfied that it was easier to heat a setting of ten retorts, in five tiers one above the other, than when they were spread out. If they wanted a greater number than seven or eight, it was better to go up. He said, therefore, that a setting of ten was a good setting; and he knew it was a cheap one. They did not adopt regenerative furnaces, but had producer furnaces without the regenerator; so there was a little saving there. Regeneration cost a good deal of money; and he did not think it was worth the expense. Mr. Ball had alluded to breakdowns; and undoubtedly such things did occur. But these difficulties were overcome; and the delays very seldom extended beyond 15 minutes. Of course, the machine had to be repaired and overhauled thoroughly from time to time; but the ordinary daily repairs were very small indeed—in fact, considering that two-fifths of the retorts were quite out of the reach of the men, and that there were no temporary stages to take the place of the machine, it would be a very serious matter if it did ever break down. His experience of the inclined retort system was satisfactory; and there were places where one could not put in a machine, but could have inclined retorts. Mr. West had referred to the testing of the illuminating power and the quantity of the gas. He (Mr. Livesey) must confess that he quite expected some illuminating power would be lost with the inclined retort system, for the reasons mentioned in the paper and by Mr. Methven—that the gas travelled against the heated sides of the retorts; but, on going into the matter carefully, he could not find any difference in the quality. He rather qualified his remark about quantity, because he knew the coals were not the same. But they had since had longer experience; and he could not say that the quantity was in any way reduced. There was no doubt whatever that one had much more control in charging by machinery than in charging an inclined retort. Possibly these difficulties might be overcome in the future; but he could not say they had been yet. If the coals happened to be all lumps, they might run to the bottom of the retort, and leave 3 or 4 feet at the top with nothing at all in it; and if they were all dust, they would be all at the top. He was still of opinion that, given certain work to do, the working of retorts by machinery was, on the whole, by far the better. The cost of the machines which he had given was heavy; but he had taken them for a setting of ten, which required heavier machines than when the setting was only three or four tiers high. But there was one great point about the cost of the inclined retorts. Anybody who had watched the erection of retort-settings on that system would have noticed that often a retort-setter, after cutting a brick for ten minutes, would have it break in half, and he would have to begin again. It was this that made the building of the settings so expensive.

DISCUSSION ON MR. J. TYSOE'S PAPER ON THE "FOULIS-ARROL STOKING MACHINERY AT EAST GREENWICH."

Mr. G. E. STEVENSON said he had not had any experience of the machines referred to in the paper, although he had seen them working; and he hoped to have some in operation by-and-bye. He had had something to do with hydraulic machines of an older type; and there were many advantages in the use of hydraulic power—some of them being the absence of noise, the convenient way in which the power could be carried to any point, and the comparatively small cost of supplying it. He noted the remark about the cost of water, where it had to be paid for; but this would not amount to much, because it could be used over and over again. In Manchester they brought it all back to the tanks; and there was only a small leakage. He was pleased to observe the low cost of carbonizing referred to, which he thought was the lowest he had seen stated anywhere. He did not know of any machinery that carbonized at 1s. 6d. per ton, including all expenses—in fact, he knew of nothing less than 1s. 9d., and this only under very favourable circumstances.

Mr. SALAMAN (Amsterdam) said the paper under discussion was so complete that he could not add much to it; but his experience coincided to a very great extent with the author's. He thought that it was owing to the reading of a paper by Mr. Tysoe in 1891* that he first thought of introducing these machines into the works at Amsterdam; and that was almost the first practical introduction of stoking machinery abroad. The Imperial Continental Gas Association, who were the pioneers of the gas industry on the Continent, had therefore been the first to adopt stoking machinery abroad on any large scale. He believed there was an installation at Charlottenburg, near Berlin; but it was rather a cumbersome arrangement, though worked by hydraulic power, and was not to be compared with that of Mr. Foulis. Having read Mr. Tysoe's former paper, and having labour difficulties, it struck him that it would be a good thing to introduce machinery with hydraulic power; and he thought the most suitable appliance would be that of Mr. Foulis. Accordingly, in the autumn of 1892, they began with one drawing-machine, and then ordered three more; so that since 1892 they had been at one works entirely using Foulis's drawing-machine for all the retorts, on a make in the winter of about 2½ millions. Up to the present time, they had had every reason to be satisfied. Of course, there had been some trifling breakdowns; but they were very easily remedied. If they had duplicate parts of the machine ready at hand, it was only a small matter to replace them if anything happened. They found, as Mr. Tysoe did, that with their coal, which was partly English and partly German, the rams had to be made stronger, so as to develop more power than sufficed in Scotland. In the summer of 1892, they erected one of the charging-machines; and they found it worked so satisfactorily that they were now erecting others, so as to be able to perform all the charging of the retorts with these machines during the coming winter. They had special reasons for not wishing to increase the capital account; and as they had no coal breakers or elevators, they had to consider some cheap and simple way of filling the hoppers. They first thought of having a separate hydraulic crane running behind them. They suggested this to Messrs. Arrol and Foulis; but they improved upon the idea by proposing to put a crane at the side of the machine. Accordingly the hopper was filled by a simple hydraulic crane, which ran along with the machine; and the buckets were filled by two men, and discharged into the hopper. They had the coal all along the benches, and two men on the floor filling the buckets; thus saving the labour of wheeling the coal to the elevator, and the wear and tear of the elevator and the cost of breaking the coal. Of course, the two men, besides filling the buckets, had to break any large pieces of coal. But one advantage of the Foulis machine was that the coal did not need to be broken up very small. Only very large lumps had to be broken; and this was easily done by hand as the machine travelled along. He could not give the exact saving in figures; but it was not quite so large as at East Greenwich, because they worked on twelve-hour shifts.

Mr. S. GLOVER (St. Helens) said that for the last seven years or so he had been working with Mr. West's manual stoking machinery; and during this time he found they had charged 933,000 retorts. As the chargers went twice, the three scoops used during that time had made upwards of 1,800,000 journeys; and they were not yet worn out. In the meantime, they had only to renew the backbone of one; so that they were very well satisfied with the machinery. However, as they would soon need extensions, he was on the look-out for the best machine for the future. He had been thinking about the way in which the charge was put into the retort; and it had struck him that possibly it would not be delivered very evenly by the new machine. Sometimes old retorts were not quite horizontal—he did not refer to inclined retorts, but meant that the floor was not quite horizontal; and if the rake-shaft was rigid, possibly the charge might be laid in heaps and valleys. He asked if this was so.

Mr. FOULIS said the rake-rod was not rigid; it followed any inequality in the retort.

Mr. GLOVER said there was one little point early in the paper which was not quite clear to his mind. It was where the author said that the men charged double the number of retorts that they had previously drawn and charged. Seeing that drawing could be done by a manual machine, without hydraulic power, very quickly, he should think a machine like this was only necessary or economical where hydraulic power was already provided. Then with regard to regulating the charge, he understood the man could, if he pleased, leave out the last portion; but if he came to a retort or setting which was not quite so hot as it should be, could he quickly modify the charge to the temperature of that retort? As to speed, he must say that at St. Helens he could almost do the work with a manual machine as quickly as with a power machine. On one occasion quite recently, when there was a Committee visiting the works, they placed their Engineer in rather an awkward position by asking him if he did not think the working of the retorts was performed more quickly than he was doing it at his place with power machinery. As a matter of fact, he tried it a few weeks previously, and found that, from the time of starting the charge to the finish and closing of the lids, it was less than half a minute per retort per charge. He should be glad if Mr. Tysoe would state the weight of charge per retort, whether the charges were evenly burnt off, and how long the machines were at work. He noticed that this machine was traversed by hand. In some power machines that work was done by machinery. Knowing the small wear and tear which the hand machine involved, he thought there would be a great deal more with machinery of the kind described; and it appeared to him that the rams would suffer considerably from exposure to the dust-laden atmosphere of the retort-house.

Mr. T. HOLGATE (Halifax) asked the exact lengths of the shifts. They were told that the machine was actually at work 7½ hours out of the 12; and it seemed to him as if the use of a power machine would lend itself to a ready arrangement whereby two shifts could be employed instead of three, without entailing an unduly lengthened period of work.

Mr. T. MAY (Richmond) said that he had worked West's manual machines for some years; but, having given his experience with them at previous meetings, he had not come prepared with any figures. The machines described in the paper were, of course, only suitable for large works; and he had had no experience of their use. But the hand machines referred to were better suited to the requirements of medium-sized works, such as St. Helens and Richmond, where they had been very successful. The labour was light, and the wear and tear small. He, however, took the present opportunity of again expressing his opinion that, of all the rakes he had seen, West's hand rake was the best both for rapidity of action and the manner in which the retorts were drawn. It appeared that the makers of power machines had been more successful with chargers than with drawers, as they failed to give to the latter that delicacy of motion described by Mr. Frank Livesey when comparing them with hand work. As he had previously said, he was not prepared to state the cost of working. He might, however, say he had effected a very considerable saving over hand work; and he would be very sorry to have to go back to it again.

Mr. CHARLES HUNT (Birmingham) said he could bear testimony to the satisfactory character of the work performed by their hydraulic machines. Their experience at

* See JOURNAL, Vol. LVIII., p. 893.

Birmingham coincided with that described in the paper, except that they were not doing quite so much work with them, for the simple reason that they had not a sufficiency of retorts in that part of the house. They commenced with the drawing-machines about the same time as at East Greenwich. It was not all smooth sailing at first; and the size of their rams had also to be increased. The charging-machine was applied last autumn; and the two machines had been at work ever since. They found a great advantage in being able to vary the weight of the charge according to the conditions of the retort. This applied more particularly to leaving out one push at the middle or end, as described in the paper. Of course, the weight of the whole charge could be varied; but this was not readily done for a single retort. There were certain drawbacks; but they were in course of being overcome. At first they found considerable breakage of the wire ropes, and bursting of the pressure pipes; but gradually these were being greatly lessened. Having regard to previous experience with stoking machinery, and the length of time it had taken to bring it to the present state of perfection, he thought Mr. Foulis was to be congratulated on the very great success he had achieved in such an exceedingly short time. He might perhaps answer Mr. Glover's question with regard to the charges being evenly distributed. When they first began, there was a considerable amount of ridging; but this had been almost completely overcome by varying the shape of the pusher—sloping it so as to allow the coal to fall when it reached the end. There was still a very slight amount of ridging; but nothing of any consequence. At first the pusher was worked perfectly vertical; but now it was inclined. He fully agreed with Mr. Glover and others who had referred to the rapidity with which the drawing was done by West's hand machinery. He went into this question some time ago, and found that, whereas power machinery reduced by one-half the cost of drawing and charging, hand machines came midway between the two; and therefore hand machinery, however excellent it might be for moderate makes, was scarcely admissible for large works, where power could be applied. Mr. Salaman had referred to an arrangement of crane by which he filled the hopper without having recourse to expensive coal elevators; but he (Mr. Hunt) was afraid it was rather a tax on the machine to add two men to each charger for the purpose of filling the hopper. It must take away a very large portion of the saving effected by the use of the machine. He would ask Mr. Carpenter if he would be good enough to describe the machine illustrated in the last volume of the Transactions of the Institution, which had an elevator upon it for practically the same purpose. In both cases, he took it that the coal to be dealt with did not require much breaking. They used all kinds of coal, and most of it had to be very much broken up; so that he was afraid neither system would be admissible in their case. If it were, it would very largely save the cost of the installation. It was not the machinery itself that involved the principal cost, but the coal-breakers and overhead hoppers, which were necessary auxiliaries.

Mr. C. C. Carpenter (Vauxhall) said he was afraid he should have to ask Mr. Hunt to wait for another twelvemonth before getting the information he required. The retort-house illustrated in the Transactions was at present working by hand only. He hoped to have the machinery in full operation in the coming winter, and to present a paper on the subject next year. There were one or two points in the paper on which it struck him that a little further information would be desirable. In working out the weight of the charge from the figures given in the paper, it came to about $5\frac{3}{4}$ cwt. per retort. Now, while it was possible to go too far in increasing the weight of the charge, it also seemed to him that it could not be right to go back. Mr. Hunt, in a paper read before another Institution,* laid some stress on the fact that the ideal weight of charge had not yet been determined. As far as his own experience had gone, there was no disadvantage in working a charge, in order to get the highest illuminating effect and the maximum quantity of gas per ton, of, under the present carbonizing system, at least 6 cwt. per retort; and he should like to know whether it was an essential of this machine to reduce the charge to $5\frac{3}{4}$ cwt. Their average charge at Vauxhall for hand labour came to a fraction above 6 cwt. Working out the cost per ton on these lines, excluding good-conduct money (an additional charge which only the South Metropolitan Company paid, and which he presumed would not be included in the charge for working given in the paper), the cost of hand working for drawing and charging, including cleaning the pipes, instead of coming to 26·3d. per ton, came to 22d. only; so that the difference as between his hand work and his particular machine work must, as far as he could make out, be reduced by 4·3d. Another point which had not been touched upon by previous speakers was this: The machine was actuated by hydraulic power; but, in order to traverse it along the stage, they had a wire rope driven by a gas-engine. He should be pleased to hear why this rope was added to the machine, to traverse it along the stage, in preference to using the hydraulic power already attached. They had been experimenting at Vauxhall with two of these drawing-machines, which they had to modify somewhat in order to suit their special requirements; and they had hitherto had a good deal of trouble with the bursting of the hose. He gathered that Mr. Tysoe had experienced some difficulty in this respect; because it seemed to him that he had had to cut down these to a minimum—adding a stand-pipe opposite every two or three benches to which the machine was coupled up. He should like to know whether he considered this was a serious objection, a slight one, or none at all.

Mr. West said this subject seemed to be one in which they all took a great interest; and naturally so, when they found they could save these large sums by using mechanical appliances, which went towards reduction in the price of gas, thereby benefiting the consumers. One of his primary objects in early days was to do away with the arduous work of the stoker; but now his chief object was to get money out of the selling of his machines. Both Mr. Foulis and himself had had large experience in connection with this matter; and they had both demonstrated that the work could be done more economically by machinery than by hand labour. The only question between them was which was the best machine to adopt. He had had large experience with Mr. Foulis's machines at Manchester, and took credit for working them as well while he was there as they had ever been worked before or since; but he was not quite at one with Mr. Foulis with regard to motive power. He thought compressed air was superior, for it was more easily handled. Atmospheric air cost nothing, and required no pipes and no fettering arrangements to bring it to the compressor; and recent improvements in its production and application had certainly brought it to the front. The machines described by Mr. Tysoe were much lighter than the older ones at Manchester and elsewhere, where the Woodward-Foulis machine was first adopted. The new machines were especially light; and knowing what he did, he could understand the mistakes which had been made in that direction. In Glasgow, they had to draw out cannel coke, which required but very little power; but when this machine was brought into the London district, the rams had to be enlarged and the whole thing strengthened. All makers of machinery erred in this direction; and a machine which worked satisfactorily at Manchester (where the work was harder than at Glasgow) would not perform the work satisfactorily at Beckton, where the material required more power. The machine had therefore to be stronger. In these machines, he thought some of his ideas had been followed; and it occurred to him that a machine which weighed about $9\frac{1}{2}$ tons, with coal, was rather too heavy to be traversed by manual power. The manual machines which he made for some years were quite heavy enough for men to work; and they weighed, with coal, only about one-half. But if power were added to traverse the machine, it would increase the cost; and they would have to be further strengthened. He formerly used very light rakes, which were propelled by the men themselves; but they were now adding small motors, so that the whole of the work could be done by simply moving levers. He was not alone in his idea that compressed air would be the power of the future for intermittent work, and with varying loads, as was the case in the retort-house. An important paper on this subject had been recently read in connection with the Portsmouth Dock Works. In the modern yards, there was a large installation of compressed air plant, hydraulic plant, and steam power; and large experiments had been made. They had forty 7-ton capstans,

* See *ante*, p. 651.

2¾ miles of air-pipes of 3 inches to 12 inches diameter, 20-ton cranes, and a considerable quantity of other kinds of machinery; and they found that for this class of machinery compressed air was the most efficient. Mr. Corner, the Chief Engineer, in a paper read before the Institution of Mechanical Engineers, gave the respective efficiency of compressed air and hydraulic power as 13 to 11. But since then the air-compressors had been much improved; and they had now the most efficient machinery ever made. He must say that it was the foreigners who were most in advance on this subject, because of the comparatively great cost of fuel on the Continent. The idea seemed to be abroad that he (Mr. West) could not deal with large coal; but with his manual machine, he could deal with lumps of 2 to 3 inches cube, and with the power-machines he could deal with anything—in fact, large coal could be dealt with better by his machine than by Mr. Foulis's. Another point which had been lightly touched upon was the cost of water and the wear and tear of the machinery and glands. He was glad to notice the large reduction in labour. He was at East Greenwich not long ago, when Mr. Tysoe told him he had sixty men at work in two retort-houses, when, if they had been working by hand power, there would be 160; and this question therefore had some bearing on the paper read the previous day by Mr. Livesey, in which, probably, he took a little more credit for the bonus system than it was justly entitled to. He thought, however, that the reduction in the cost of carbonizing had been brought about partly by the addition of machinery, which had not only reduced the cost, but had done away with possible units of discontent in the ratio of 160 to 60.

Mr. Corbet Woodall said he had not intended to speak on the paper, but he should like to make a remark or two in reference to what Mr. West had said. The comparison he had drawn between compressed air and hydraulic power was a little beyond the region of theory; and practice had to a large extent demonstrated the facts. He had given an illustration of the Portsmouth Dockyard; and, on the strength of the opinion of the Engineer, he had come to the conclusion that all the experience of the past in favour of hydraulic power was a mistake. They might safely leave it to time to demonstrate which was the better of the two. At any rate, all the efforts made hitherto to distribute compressed air had been comparative failures; while the distribution of hydraulic power still continued to be increasingly successful. With regard to the machines described in Mr. Tysoe's paper, he had had some opportunity of observing them; and the results had been such as to encourage him (Mr. Woodall) to apply them to two of the larger gas-works in Vienna, where recently some trouble had been experienced with labour, and it was necessary to meet these troubles by mechanical means. Before determining on adopting this particular machine, he had had the advantage of meeting Mr. Tysoe at East Greenwich, and witnessing the apparatus in operation; and he was much attracted by the machines as being more suited to the work he wanted done than any other machine he had seen. He was not making any comparison as to the efficiency of the two, because this had been put before the Institution in the present and former papers; but, to his mind, these machines were almost ideal in their adaptability to the work to be done. A question had been asked as to the distribution of the coal in the retorts. To satisfy himself on this point, he had a few cold retorts filled, and then had lights drawn over the surface of the charge; and he could only describe the result as simply perfect. There was hardly a trace of any wavy line in the coal at all. Mr. Salaman's experience at Amsterdam, which he had had the opportunity of watching with him, was in the same direction. When the charges were burnt off, and one looked into the retorts, it was found that the distribution was beautifully perfect. References had been made to the crane attached to the machine for picking up the coal from the stage into the hopper. Of course, neither Mr. Salaman nor anyone else would recommend a system of this kind if they were building a retort-house for the first time. But in Amsterdam there were certain reasons for not making any considerable new expenditure; and this arrangement was devised to keep it down as low as possible. In Vienna, they were converting a portion of a coke-vault into a large hopper, in the base of which the breaker was intended to be fixed; and the coal was elevated into the hopper head, from which the travelling hopper was fed. There was naturally an objection to loading the machine with extra weight when it was already heavily enough charged with coal. Mr. Carpenter spoke of the undesirability of using a gas-engine and rope to traverse a machine, when hydraulic power was available. He (Mr. Woodall) was a great believer in hydraulic power; but he recognized that it had its field, and hydraulic motors for continuous rotary work at present did not compare favourably with either steam or gas motors. For comparatively small work like this, he entirely agreed that the right thing was to put a hydraulic motor on the machine, because the amount of work to be done was so little that it did not justify introducing a second system of power. They were now using hydraulic motors partly for electric light and partly for this purpose; and one would be used for working these machines. It developed 65 to 70 per cent. efficiency, which was quite good enough for the purpose in view. Mr. Glover referred to the probability of the wear and tear being considerable, because of the amount of dust in the retort-house atmosphere. Undoubtedly, it was very desirable that the parts of the machine should be carefully safeguarded from dust; but it must be remembered that the atmosphere of retort-houses operated by a machine of this kind was very different from that of an ordinary retort-house worked by hand. The amount of dust was so much less that the injurious result was to that extent reduced. There was, however, another matter which required to be attended to—the water used should be filtered, because if dirty water were used, both the rams and the faced valves were very likely to be scored, and thus cause trouble.

Mr. West said he should like to add one word with regard to compressed air. Mr. Woodall had pointed to the failure of the only public system introduced in England—that was at Birmingham. But it was well known that the system was never at fault; and the cause of the failure was the wasteful method of working, the defective mains, and the fact that the preliminary expenses were altogether out of proportion to the turnout. If the system were introduced now, with the benefit of all recent improvement and knowledge, such a result would not occur.

Mr. Denny Lane asked if anyone had knowledge of a stoking and drawing machine invented a short time ago, in which the motive power was derived from a gas-engine placed on the machine itself. He believed it would be found extremely cheap; and there would be no danger of bursting pipes or any other accident.

The President having thanked Mr. Tysoe for his interesting paper,

Mr. Tysoe, in reply, said he was under the impression that there was very little debateable matter in the paper, and that there would not be much to answer; but the discussion that had been brought forth rendered an adequate reply a somewhat difficult matter. The absence of noise, mentioned by Mr. Stevenson, was a great point in favour of the machines, and well worth consideration. The cost of water would, of course, be reduced if it could all be collected and returned to the tank, which might easily be done. With regard to the wear and tear, it certainly was larger than it should be; and this brought out the point mentioned by Mr. Woodall with regard to the water. At East Greenwich, they were compelled to use water pumped direct from the Thames, which was very bad indeed, as it contained a lot of suspended matter; and consequently the packings were cut, and this very much added to the cost of repairs. He was now considering the question of filtering the water. The point as to the rigidity of the pusher-bar had been answered by Mr. Foulis; and he might add that it adapted itself perfectly to the inequalities of the retorts. Many of the retorts were not level; but no difficulty arose from this fact, as the coal was even in thickness, though it lay on an uneven bottom. With regard to modifying the charge, there was a small hand-wheel which actuated the stop, so that the man could if desired put in an extra number of charges. Frequently, if the middle of the retort were hot, after his first push he would turn that one-sixth back, and push in another charge, so as to fill up the middle of the retort. In addition to this, the last portion could be left out if deemed advisable. The arrangement for modifying the charge was at the top, in connection with the drum; but this could not be altered at every retort. If on one particular day the heats were down a little, it was a simple matter, by altering the ratchet, to reduce the charge

by 2 or 3 lbs., or any other amount required. They tried their utmost to keep the heats regular throughout each setting; and they attained this object better than they used to do when it did not matter so much. The weight of the charge was 5¾ cwt.; and the number of charges per hour was given in the paper. The length of the shift was ten hours. The men started at six and finished at four; and out of the ten hours they were actually at work seven and a half hours. With regard to the hand machines, if he were in small works he should certainly adopt them, as he thought highly of them; but when they came to works with retorts five tiers in height, he did not think there were any hand machines that would work them. He found that the wear and tear of the wire ropes and pipes was considerable at first, but much less now. In everything new, something had to be learnt; and they were able to work these machines better after a time. He had done away with as much hose-pipe as possible, and replaced it by iron hydraulic pipe. The reason for using 5¾ cwt. charges was that, unfortunately, they had shallow retorts; and if they put more in, they could not get it out—the rake-head would not clear the top of the coke, but would push it up in the middle. When these retorts were burnt out, and new ones of a greater depth were put in, he should adopt heavier charges. He did not quite follow Mr. Carpenter's remark that the hand work should have been 4d. per ton less. He gave the actual cost of their hand work, and compared it with the cost by machine work. As to the proposal for moving the charger along by means of a wire rope, this would dispense with one man at each machine. In Glasgow, an arrangement for propelling the machine by hydraulic power was in use; but one reason which weighed with him was that they had ample power in the existing gas-engine working the elevators, to drive the machine along. If they used hydraulic power, it would be necessary to attach a pipe about every three beds to get the machine along; and the cost of maintenance would be considerable. The wire ropes, when once fixed, did not cost much afterwards. It was not his purpose to institute any comparison between the Arrol-Foulis machine and Mr. West's. He had in one house machines working by hydraulic power, and in an adjoining house West's machines; and he was very well satisfied with both. Three years ago, he read a paper on the latter machine; but the figures he then gave would have to be modified now, because at that time they were working only 150 retorts, and at present they worked 200 with the same number of men. Mr. West had mentioned a point in connection with the bonus system which was worth remembering; and there was a further saving which would not occur in other places. They had now 60 men on the stage to work the machines; but if they were operated by hand, there would be 160 men. They therefore gained not only what he had stated, but the bonus which would otherwise go to the 100 men, and also the "good-time" money (3d. extra per day) given to each man who made full time.

ENRICHMENT OF COAL GAS.

By J. Ferguson Bell.

The luminosity of coal gas almost wholly depends upon 3·5 to 5 per cent. by volume of certain heavy hydrocarbon vapours which vary in their relative proportions and carbon density with the temperature at which distillation has been effected, their subsequent treatment, and the illuminating value obtainable from the coal carbonized. A high temperature of distillation means an increased volume of gas, with diminished density and lower lighting power. But, within certain well-defined limits, the increase in volume is greater than the decrease in lighting power (so that a ton of coal gives more light); the chief increase being in hydrogen, with a decrease in the percentage of the heavy hydrocarbons, which must be added to the gas, in some form or other, in order to obtain a given lighting value. The problem, then, that presents itself is how this enrichment can be most economically effected; and a brief review of what has been accomplished, along with the results obtained by the author in carburetting with petroleum spirit, carburine, and benzol, may not be altogether devoid of interest.

The predominant luminiferous hydrocarbons usually present are the olefine series, having the general formula C_nH_{2n}, and the benzene C_nH_{2n-6} series; being in the proportion of from 3 to 3·7 and 0·8 to 1·3 per cent. by volume. More recent investigations tend to prove that coal gas contains hydrocarbons of the paraffin series, which also add to its luminosity. Marsh gas, burnt under most favourable conditions, gives a luminosity of only about 5 candles, calculated to a consumption of 5 cubic feet per hour; and as the heavy hydrocarbon vapours are difficult to burn without the production of smoke and consequent loss of light, the hydrogen and marsh gas are indispensable both as diluents and carriers of the illuminating constituents.

Olefiant gas is a most valuable constituent of coal gas, and contributes approximately about 3¼ per cent. to the illuminating power for each 1 per cent. present, which is less than the light-giving effect attributed to it previously by the valuable researches of Dr. P. F. Frankland and others, who determined the relative values of the various luminiferous hydrocarbons usually present in coal gas. From these results (which are tabulated for reference on Table I.), it will be noticed that the illuminating power of the hydrocarbons varies considerably.

Table I.—*The Illuminating Power of Hydrocarbons Calculated to a Consumption of 5 Cubic Feet per Hour, and Corrected to 60° Fahr. and 30" Bar.*

Name of Gas.	Molecular Formula.	Density.	100 Cub. Ft. of Gas at 60° Fahr. and 30" Bar. Weight in Grains.	Illum. Power, Calculated to 5 Cub. Ft. per Hour.
Methane } ($C_nH_{2n} \times 2$).	$C H_4$	7·985	29,722	5·15*
Ethane } ($C_nH_{2n} \times 2$).	C_2H_6	14·970	55,538	34·80†
Propane } ($C_nH_{2n} \times 2$).	C_3H_8	20·955	81,562	53·30†
Ethylene (C_nH_{2n}) . .	C_2H_4	13·970	52,090	68·50†
Benzene (C_nH_{2n-6}) .	C_6H_6	38·910	144,879	..

Authorities.—* Mr. L. T. Wright; † Dr. P. F. Frankland.

The benzene or aromatic series (C_nH_{2n-6}) possess exceptional interest; for among all the hydrocarbons which contribute to the illuminating power, benzene and its homologues, though generally present only in the proportion of from 0·8 to 1·3 per cent. by volume, yet represent probably as much light-giving property as all the other hydrocarbons put together. Berthelot's theory on the subject is that as regards illuminating power, benzene plays a secondary part in very rich gas; an important part in gases of average richness; and contributes almost the sole source of the light given by very poor gas. This is to a great extent confirmed by the experimental researches of M. Saint-Clare Deville (as shown on Table II.), which gives the probable share due to each class of hydrocarbons in the production of 100 units of light:—

Table II.—*Probable Luminosity Contributed by Each Class of Hydrocarbons in the Production of 100 Units of Light in Gas supplied by the Paris Gas Company.*

—	Rich Gas.	Poor Gas.	Average Gas.
Benzene series	40—50	70—85	65
Olefiant series	30—15	15—7	10—20
Marsh gas	12—10	10—8	10
Higher member of marsh gas series	18—25	5—0	15—5

He found (from a large number of experiments made in order to be free from variations due to accidental deviations from normal conditions) that the average Paris gas contained, in English equivalents, 1600 to 1750 grains of benzol per 100 feet.

Pure benzene	77 per cent.
Other hydrocarbons of the aromatic series. . .	23 "

Or that from 7 to 7·5 by weight, and from 1·1 to 1·2 by volume, is hydrocarbon vapour of the benzene series; while the gas contained 4 to 4½ per cent. by volume of other uncondensable hydrocarbons. The illuminating power was found to be—

Due to benzene.	65 per cent.
" other hydrocarbons	35 "

These figures indicate the great importance of benzene vapours in ordinary illuminating gas; and Dr. Bunte found, in a series of experiments with Karlsruhe gas,* deprived as far as possible of hydrocarbon vapours by means of

* See Journal, Vol. LXII., p. 717.

fuming sulphuric acid and then carburetting with benzene, that the results in English equivalents were as follows:—

Increase in Illuminating Power.	Net Increase due to Benzene.	Benzene Used in Grains.		Benzene Vapour.	
Sperm Candles.	Candles.	Per 100 c. ft. of Gas.	Per Candle.	Per Cent. Volume Used.	Candles Per Cent. Volume.
2½ to 14½	12	1254	5·225	0·868	13·82
2½ „ 17	14½	1869	6·443	1·293	11·21
2½ „ 21¼	18¾	3068	8·179	2·124	8·82

These figures are most interesting, as they clearly show that if a gas almost devoid of illuminating power be progressively enriched with benzene, the illuminating power increases much less rapidly than its richness in hydrocarbons of the aromatic series; and this is probably common, in a more or less degree, to all other enrichers.

A number of experiments have been made by the author with a 10 cubic feet gasholder, adding percentage volumes of benzol, carburine, and petroleum spirit to ordinary coal gas of about 14-candle power, the results of which are shown on the diagram. From this it will be observed that, as the percentage volume of enricher increases, the illuminating power increases, but at a less rate for all three enrichers; also that benzol is, volume for volume, about three times as effective as carburine.

The enrichment of coal gas may be effected in various ways; and the conditions prevailing in different towns will, along with the fluctuations in the prices of the materials used, no doubt modify and determine the most suitable process to employ in order to increase the proportion of necessary illuminating constituents. These may be classified as follows:—

(*a*) Adding a percentage of cannel gas.
(*b*) „ „ high candle power water gas.
(*c*) „ „ oil gas.
(*d*) Carburetting with vapours of volatile hydrocarbons.

The oldest and probably best known method of increasing the lighting value of gas, consists in using a proportion of cannel varying with the quality and quantity of the gas obtainable from that used, and the luminosity of the gas required to be supplied. This plan has the advantage that no alterations of plant are necessary; and the illuminants added will be practically permanent and reach the consumer, although all descriptions of lighting gas experience some slight loss of their illuminating constituents in distribution. As compared with other systems of enriching, the use of cannel is now generally found more expensive; for during the past few years those cannels which give gas of a high illuminating power combined with a large yield per ton are difficult to obtain, except at high prices. Hence substitutes have been sought for, and tried with varying degrees of success. It is not necessary to give details of the cost of enrichment by cannel; but those who can effect an increase of 3 candles—say, from 15 to 18 candles—for less than 6d. per 1000 cubic feet are exceptionally placed.

The author is of the opinion that the introduction of high candle power water gas for enriching purposes is not free from objections, and will prove more costly than enriching by oil gas or carburetting. The addition to gas intended for general distribution of an enricher containing 28 to 30 per cent. of carbon monoxide (a poisonous and deadly gas) appears at least objectionable. Although those who advocate the introduction of carburetted water gas say this is of little moment, the fact remains that last year's official report of the Board of Gas and Electric Light Commissioners of Massachusetts states as follows: "The number of deaths in the United States reported to the Board from various sources during the year 1892 caused by inhaling illuminating gas is 250. Of this number 8 occurred where coal gas only is made; 70, where water gas exclusively is used; and 119, where both coal and water gas are used." These figures are not reassuring; and a grave responsibility rests upon those who increase in any degree, however slight, the danger attending the use of illuminating gas; for it would be an evil day for gas companies if the number of deaths from inhaling gas should in England rise to anything like those recorded from year to year in the United States.

The decomposition of steam by incandescent fuel into hydrogen and carbon monoxide is an endothermic reaction. The fuel in the generator is raised again to a high temperature by means of an air blast, with the production of producer water gas of low calorific value, which, unfortunately, is only partially utilized in the regenerator in gasifying and fixing the petroleum vapours—thus entailing considerable loss.

The calorific value of 50 lbs. of coke and 4¼ gallons of oil is rather more than 1⅓ millions of British thermal units; and 1000 cubic feet of 26-candle gas may be taken at 700,000 units—showing that only 53 per cent. of the heating value of the fuel used is available, the remaining 47 per cent. being lost. A process that in the reactions necessary entails a loss of upwards of one-half of the calorific value of the materials used, leaves something yet to be desired.

Mr Goulden, who presented a paper, along with Mr. Paddon, on "The Technology of Water Gas," at the second annual meeting of the Institution, gave 40 to 50 lbs. of coke and 5¼ American gallons of oil per 1000 cubic feet for 26-candle gas. Taking, then, 50 lbs. of coke at 15s. per ton, and 4¼ English gallons of oil at 3½d. per gallon, gives: Fuel, 4d.; carburetting, 1s. 3d.; and making and repairs, 6d.; or a total of 2s. 1d. per 1000 cubic feet of 25-candle gas into the holder.

Again, referring to a former report of the Massachusetts Gas Commissioners on the subject of carburetted water gas, the materials used are given as 50 lbs. of hard anthracite coal, and from 5 to 6½ gallons of oil for every 1000 feet of gas; although in the best works, and under very favourable conditions, these quantities may be slightly reduced, and the cost is from 46c. to 55c., or an average of 2s. 2d. per 1000 cubic feet into the holder.

The advantages attending the production of carburetted water gas are that a large quantity can, on an emergency, be quickly produced, and small floor space; but these advantages may be too dearly purchased.

To enrich ordinary coal gas from 14 to 17 candles with 25-candle power water gas would require about 30 per cent. of the latter; and if it can be put into the holder for 2s. 1d. per 1000 cubic feet, assuming the cost of 14-candle power unenriched gas at 1s. per 1000 cubic feet, the enriched gas would cost 15·9d. per 1000 cubic feet, being 1·3d. per candle, without allowing anything for depreciation and renewals. Also the percentage of carbon monoxide in the mixed gas would be increased 8½ per cent.

The production of rich illuminating gas from liquid hydrocarbons by destructive distillation has received special attention for some time past. This is owing no doubt to the low prices of high-gravity mineral oils; and the results obtained by the Peebles process of oil-gas manufacture has given additional interest to the subject. Mr. W. Young appears to have found, from experimental investigations in conjunction with Mr. A. Bell, jun., of Peebles, that the fractional method of decomposing the complex hydrocarbons present in heavy oils, gives a much higher illuminating value per gallon of oil than when similar oil is decomposed in ordinary oil-gas retorts worked at low temperatures. Also, by fractional condensation in conjunction with the solvent affinity of the oil used, those vapours which have not been converted into permanent gas under the ordinary conditions of distribution are returned to the retorts and again decomposed. The figures given by the author of this process are: From shale oil of ·867 specific gravity, 22,790 cubic feet of 93·8-candle gas, and 4·94 cwt. of coke per ton of oil. The cost of this oil delivered at most gas-works in England, carriage paid, is £3 10s. per ton. This works out for oil, less the value of coke and cost of making, to about 3s. 4d. per 1000 cubic feet. It is found that 5 per cent. of 90-candle power oil gas raises 14-candle gas to 17½ candles, or rather under the low figure of ½d. per candle for each 1000 cubic feet of gas enriched.

Now that coal gas tar has again fallen in value to an average of about 16s. per ton, it appears that this process for converting by destructive distillation the lighter tar oils into rich illuminating gas is worth attention, more especially at those works where reasonable prices cannot well be obtained for their surplus tar; and a statement of the results obtained, as furnished to the author, will be of interest. A trial made with tar from Yorkshire coal and a proportion of Nottingham cannel gave 14,400 cubic feet of 25-candle gas and 15 cwt. of coke per ton; with Durham coal gas tar, 13,965 cubic feet of 24-candle gas and 15 cwt. of coke. If in ordinary working 14,000 cubic feet of 24-candle gas can be obtained per ton of tar, this, deducting the value of 15 cwt. of extra quality coke at 15s. per ton,

works out, including the cost of making, at 10d. per 1000 cubic feet into the holders. From these figures it would appear that for making rich gas by the Peebles process, the value of tar is 18s. per ton; shale oil being £3 10s.

There are several other well-known systems for converting oils into rich illuminating gas. In the Keith, Pintsch, and other similar apparatus, the oil is rapidly decomposed in cast-iron retorts, worked at temperatures varying with the grade of oil used; the best result published, as obtained with shale oil of ·880 specific gravity, is 26,000 cubic feet of 53-candle gas per ton. In a paper read before the Society of Chemical Industry by Professor Vivian B. Lewes on the production of oil gas from Russian petroleum, the best result obtained with "Russian distillate oil" of ·884 specific gravity, retorts at 1600° Fahr., was stated to be 18,700 cubic feet of 57-candle gas per ton. Taking the value of the oil at £3 15s. per ton, the cost into the holder, less the value of the coke and including labour, is 4s. 3d. for 57-candle gas per 1000 cubic feet. To increase the illuminating power of gas from 14 to 18 candles would require 10 per cent. of this gas, which means 1d. per candle—a figure much in excess of that said to be obtained by the Peebles process.

It is claimed for Tatham's oxy-oil gas process that 25,000 cubic feet of 80-candle power gas can be obtained per ton of Russian solar distillate; and that an enrichment of coal gas by oxy-oil gas would cost about 0·33d. per candle for each 1000 cubic feet. These figures, however, need further confirmation; and the additional expense of the oxygen plant, along with the cost of working the same, will probably limit its introduction.

The carburetting of coal gas or enrichment by volatile hydrocarbon vapours, has, until the last few years, been regarded as somewhat delusive; and no doubt it is too often associated with imaginary schemes of making cheap gas, which has not tended to add confidence in carburetting. But that this method of enrichment is feasible cannot now be disputed; the question being, Can enrichers be obtained sufficiently cheap to warrant their use and to compete with other methods? By this system certain volatile hydrocarbon liquids must be used, which are somewhat expensive, as dependence is placed upon the vapour tension of the liquid, in order that the enriched gas may take up the hydrocarbons and carry them.

When liquids are vaporized at about 100° C., care must be taken to add only such a percentage volume as can be permanently retained and carried by the gas; any surplus will simply condense and entail loss. The author's experiments in carburetting have been carried out during the past few months with petroleum spirit of ·700 specific gravity, carburine or petroleum naphtha of ·670 specific gravity, and 90 per cent. benzol of ·880 specific gravity. The apparatus used is simple and inexpensive; being an ordinary feed-water heater of a type often employed in connection with steam-boilers. The liquid is run into the top part of the vaporizer by gravity from a small overhead cistern. On the side is placed a small glass cylinder, so that the quantity of liquid that is being passed into the evaporator may be observed. It runs upon a flat plate, the outer edge of which is turned up slightly, and serrated; a sheet of perforated gauze being fixed under this plate, so that the portion of liquid enricher not vaporized flows over the edge of the plate, is distributed, and passes down the vertical tubes, on the outside of which is steam at 30 lbs. pressure per square inch, or a temperature of 250° Fahr. The bottom part of the vaporizer is connected, by a 2-inch pipe, with a 15-inch main, conveying the make of gas to the station meter, and arranged so as to cause a flow of gas through the vaporizer. This gas, passing up through vertical tubes, is slightly heated, thereby helping to vaporize and carry the heavy hydrocarbon vapours into the 15-inch main, where they mix with the unenriched gas and pass on to the station meter and holders. If desired, the arrangement can be altered to carburet the gas at the outlet of the station governors.

The method of working is that a supply of enriching liquid is pumped from an underground store-cistern into a small tank placed a few feet above the evaporator. The flow is adjusted by a valve on the oil-supply pipe according to the make of gas and the degree of enrichment required. The quantity passing is observed by means of the small glass cylinder through which the liquid drops. The quantity of gas passing through the heater can be regulated by a valve on the inlet flow-pipe; and the steam from the boiler, according to the boiling points of the various enriching materials used. A steam-trap is provided to draw off condensed water; and an outlet steam-pipe is provided in order that the pressure of steam in the evaporator, and hence the temperature, can be regulated as desired.

Petroleum spirit of ·700 specific gravity, which can be obtained at from 5½d. to 6d. per gallon, was repeatedly tried; and the average results obtained are that it requires to increase 14-candle power coal gas to 17 candles, about 0·6 gallon for each 1000 cubic feet. The cost is, therefore, just under 1·2d. per candle for each 1000 cubic feet of gas enriched. No difficulty is experienced, and the enrichment so far as can be ascertained is permanent, and the enriched gas does not deteriorate by being stored in gasholders or in distribution more than ordinary gas of equal illuminating power.

Carburine or petroleum naphtha of ·680 specific gravity, of similar quality to that used in the Clark-Maxim carburettors which are employed for enriching gas in various towns with much success, has been also tried; and the results obtained practically agree with figures already given by those who have used the Clark-Maxim process of gas enrichment. The cost of petroleum naphtha of ·680 specific gravity is 9d. per gallon delivered at Stafford; and to raise gas from 15 to 18 candles requires about ½ gallon per 1000 cubic feet. The cost, therefore, is 4½d. per 1000 cubic feet for 3 candles, or 1½d. per candle. This method of enrichment of gas from 15 to 18 candles appears to be permanent; and it can be recommended as an easy system of increasing the candle power of coal gas within moderate limits.

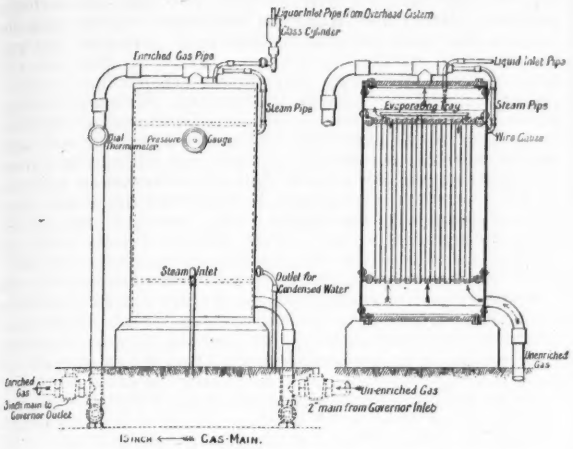
The suggestion that coal tar benzol at present prices is an economical substitute for cannel as an enricher is not new. But, so far as the author knows, the methods now used for increasing the luminosity of gas by carburetting invariably use volatile liquid hydrocarbons derived from petroleum; and until very recently the price of benzol has been such that its employment as an enricher was out of the question. But with 90 per cent. benzol at 1s. 3d. per gallon, its judicious use as a carburetting agent appears worthy of consideration. Besides, if the surplus benzol can be profitably removed from the market (either for enriching, in conjunction with light petroleum naphtha or alone), it should be to the advantage of gas suppliers, as this would at least maintain present prices, and tend to increase the value of tar.

The permanency of benzolized gas and the requisite quantity are questions essentially of the first importance, as even at present prices it is expensive compared with the price per gallon for other volatile liquid enrichers. But as so much less is required to give a corresponding enrichment, it will be found that, at present relative prices, the more expensive is actually the cheapest—similarly as the higher-priced cannels may be the cheapest.

The term benzol is applied as a general one to the more volatile portions of redistilled coal-tar naphtha. It is a liquid consisting chiefly of benzene with its homologues, together with various impurities present in minute quantities; whereas the term benzene is that given to a definite hydrocarbon having the formula $C_6 H_6$. Commercial 90's, 50's, or 30's benzol are classified according to the results obtained on distillation. A good sample of 90's should not begin to distil under 80° C., and should not yield more than from 20 to 30 per cent. at 85° C., or much over 90 per cent. at 100° C.

When coal gas is carburetted by benzol or other volatile hydrocarbon liquids, the quantity that will be taken up and permanently retained depends, as already stated, upon the gas and vapour tension of the hydrocarbon used. Ordinary illuminating gas of 16-candle power usually contains, at 0° C. and 30 inches of mercury, about 1 per cent. of benzene; and it will absorb at this temperature and pressure about 3½ per cent. by volume before becoming saturated. Thus at freezing-point coal gas contains only one-third of its saturating quantity of benzene vapours; and as coal gas under ordinary conditions of distribution would seldom fall to freezing-point, it appears admissible to increase the quantity of benzene usually present.

The addition of 1 per cent. by volume of benzol vapours will most probably be permanently retained in the gas; and this addition will increase the luminosity of ordinary coal gas from 14 to 22 candles. It is found in practice that one gallon of ordinary 90's benzol to each 10,000



VAPORIZER FOR ENRICHING GAS WITH HYDROCARBON LIQUIDS.

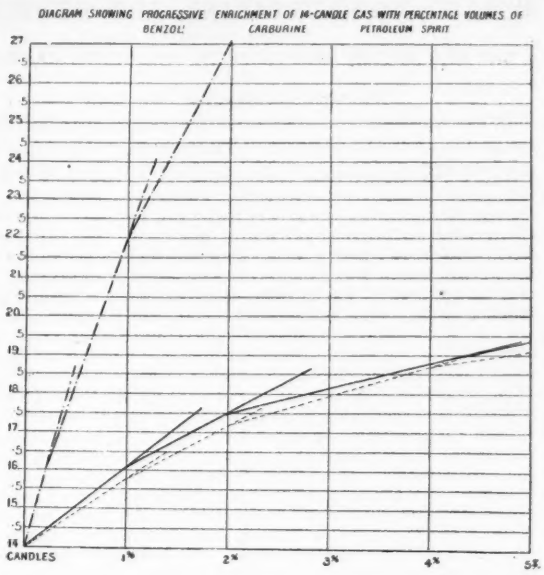


TABLE III.—*Comparative Cost of Various Enrichers.*

—	Cannel.	High Candle Power Water Gas.	Rich Oil Gas, Ordinary Oil-Gas Retorts. Russian Distillate, ·864 Sp.Gr.	Rich Oil Gas by Peebles Process. Shale Oil, ·867 Sp. Gr.	Carburetting.		
					Petroleum. Spirit, ·700 Sp. Gr.	Carburine. Naphtha, ·670 Sp. Gr.	Benzol. 90 per cent., ·880 Sp. Gr.
Present cost per ton of enricher used. .	30s.	75s.	75s.	70s.	160s.	245s.	316s.
Value of residuals, if any	6s.	[see foot-note]	5s.	5s.	..	..	..
Gas made, in cubic feet, per 2240 lbs.. .	10,800	73,000	18,700	22,000	..	..	..
Ill. power, in sperm candles, per 5 cub. ft..	25	25	57	90	..	..	..
Cost per 1000 cubic feet into gasholder .	32d.	25d.	51d.	40d.	..	..	..
Quantity necessary to raise 1000 cubic feet of coal gas from 15 to 17 candles .	200 cub. ft.	200 cub. ft.	47·6 cub. ft.	26·6 cub. ft.	0·40 gall.	0·33 gall.	0·10 gall.
Cost for each candle per 1000 cubic feet .	2·00d.	1·30d.	0·98d.	0·37d.	1·10d.	1·43d.	0·75d.
Cost per ton of coal	20·00d.	13·00d.	10·00d.	4·00d.	11·00d.	14·00d.	8·00d.

Note.—Fuel used, 50 lbs. per 1000 cubic feet = 24s. 6d., to be added for 73,000 cubic feet per ton.

cubic feet will increase the illuminating power from 15 to 17 candles, which at 1s. 3d. per gallon for the enricher gives 1s. 3d. per ton of coal, or 0·75d. per 1000 cubic feet for each candle.

By means of similar vaporizers, as used by the author, it is quite an easy matter for either benzol, carburine, or petroleum spirit to be used; and the question resolves itself into the comparative prices per gallon, along with the efficiency obtainable from these three enrichers. There are no difficulties in carburetting gas in bulk to a moderate degree of enrichment; and the facility with which the illuminating power can be increased as may be required is a strong recommendation. Besides this, the apparatus can be applied without alterations to existing plant, and obtained at a nominal cost.

In any calculations made as to the cost of increasing the illuminating power of coal gas, allowance must be made for fluctuations in the price of the enriching materials, which will modify the results given in Table III. But alterations in value, along with the improved results obtainable, can be calculated and allowed for accordingly. From the figures given, it will be seen that the cost of enrichment may be easily effected at a figure not exceeding 1½d. per 1000 cubic feet for each candle increase from an initial 15 to 18 candles, which means, of course, 4½d. per 1000 cubic feet on the price of the gas.

During the daytime, the bulk of the gas sent out is used for cooking, heating, and motive power, for which there is an increasing demand; and for these purposes gas at 15 candles is practically as efficient as the higher illuminating and more expensive quality. Hence it would appear that gas companies should be permitted to supply during the daytime gas of lower illuminating power, and such as can be obtained, without extra cost of enrichment, from ordinary gas coal. One hour before sunset until midnight, the candle power should be increased to the full standard, as during this period the bulk is used for lighting purposes, and consumers then want to purchase light, not heat.

Grand Junction Water-Works Company.—At the forthcoming ordinary meeting of this Company, the Directors will propose a dividend at the rate of 8½ per cent. per annum for the six months ending March 31 last.

The Directorate of the Singapore Gas Company.—We regret to learn that Mr. F. A. M. Nicol, who has been a Director of the Singapore Gas Company, Limited, for the past 30 years, died on the 12th inst. The seat has been filled by the election of Mr. R. Garraway Rice.

Institution of Civil Engineers.—At the last ballot for members of this Institution, the following gentlemen were admitted as associate members: Mr. C. Bourne, of the Milan Gas-Works; Mr. A. T. Fletcher, Manager of the Leigh (Lancs.) Gas and Water Works; Mr. J. G. Newbigging, Manager of the Macclesfield Gas-Works; and Mr. J. N. Reeson, of Beckton.

Appointments at the Manchester Gas-Works.—Mr. J. S. Naylor, who was formerly Assistant-Manager at the Cleckheaton Gas-Works, and who has been for two years Manager of the gas-works of the Selby Local Board, has been appointed by the Gas Committee of the Manchester Corporation to the managership of their Droylsden station; this post having been rendered vacant by the transference of Mr. J. R. Hill to the Rochdale Road station, where he is to be the Assistant-Manager. Mr. T. H. Duxbury, son of Mr. T. Duxbury, of Darwen, has been appointed Assistant to Mr. Rodger, the Manager of the Bradford Road station, Manchester.

Liverpool Polytechnic Society.—The sixth ordinary meeting for the current session of this Society was held on Monday last week, at the Royal Institution—the President (Mr. H. Ashton Hill, Assoc.M.Inst.C.E.) in the chair. A paper was read by Mr. Stephen J. Lett (Analyst at the Wallasey Gas and Water Works), entitled "The Quality of Water for Domestic and Technical Purposes." In the course of a rather long communication, the speaker, after dealing with the impurities usually met with in potable waters, and the methods by which they may be recognized by chemical means, referred to the danger of certain waters being contaminated by lead when this metal is used in its distribution. As a means of overcoming this, he advocated the use of tin-lined pipes. Dealing with the question of water purification, the speaker first explained the methods whereby this is accomplished in Nature; and he then dealt at some length with the chemical and mechanical means of attaining the same object.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1025.)

THE line which things in the Stock Exchange have taken during the past week is rather singular. The general tone was somewhat doubtful and hesitating at the opening; and next it fell very flat, and business was extremely restricted. Suddenly a turn for the better set in; and everything began to revive, even in the weaker and more speculative quarters. The revival was well maintained; and a really cheerful feeling prevailed right up to the close. The precise cause of this phenomenon is not clearly apparent; but anyhow it is welcome. While stuff of inferior quality was in doubtful mood, the choicest securities continued steadily ascending in value, impelled upward by the irresistible force of over-abundant money. Consols are at 101¼, and the best railway debenture stocks are at prices returning only 2¾ per cent. for money; and yet there is good reason to believe it would be a profitable speculation to buy them at these figures, such is the dearth of facilities for the employment of money. As for the Money Market, it might almost be said that, like the snake of Ireland, "there is none." Business in the Gas Market has been fair; and almost all issues may be set down as steady and unchanged. No quotations have moved at all, except these of the three South Metropolitan issues. Gaslight "A" was moderately dealt in, and showed a fair disposition towards making better prices than those which have ruled of late; but the movement was not sufficiently pronounced to affect the quotation. The secured issues were very active. Transactions were extensive in South Metropolitan "B," less so in "C," and altogether absent in "A;" but a general advance in price was made by all three issues. Commercial old changed hands once or twice at good figures. The Suburban and Provincial undertakings were almost inert; only one or two bargains being marked all through the week. The Continentals also had a lull—business being of the most meagre proportions; and all the rest were equally quiet. Transactions in the Water Companies were somewhat irregular. One or two issues have made slight advances in value; but these are more than counterbalanced numerically by small retrogressions on the part of others, as noted in our Stock and Share List on p. 1025.

The daily operations were: Business in Gas was extremely quiet on the opening day; and transactions were insufficient to afford any indication of a tendency either way. Quotations in Gas remained unchanged; but Grand Junction Water rose 1. Tuesday was more brisk; but dealings were almost wholly confined to Gaslights and South Metropolitans—prices being good, as a rule. Grand Junction rose ½ more. Wednesday relapsed into quietude again; but the favourable tendency was marked by a rise in South Metropolitan "A" and "B" of 2 each. East London Water fell 2. Greater activity was apparent on Thursday, especially in Gaslight "A" at improving figures; but quotations throughout underwent no alteration. In Water, Lambeth and New River dropped 2 each; and West Middlesex, 1. Friday's business was moderate; and the only move was an advance of 3 in South Metropolitan "C." Southwark Water rose 1. Saturday was more active than usual; but quotations closed without further change.

ELECTRIC LIGHTING MEMORANDA.

Mr. R. E. Crompton on the Cost of Electric Energy—The Future of Intramural Electric Light Stations—Dr. John Hopkinson on Mathematics and Engineering—The Fatuity of American Competing Supply Systems.

MR. R. E. CROMPTON has been lecturing his fellow-electricians upon the cost of producing electrical energy, taking account of the scale of and also of the purposes for which this work is done now-a-days. The effect has been to further depress the followers of an already by no means too prosperous industry. Mr. Crompton has made a reputation for exhibiting in the light of day the brightness and the shadows of central station work. To him we owe the useful conception and definition of the "load factor;" and he has now put upon record some of the technical reasons why electric lighting is and must continue to be dear. The engineering work of a central lighting station does not materially differ from the same class of work upon an ocean liner or in a spinning-mill. Boilers and their stoking, steam-engines and their lubrication, dynamos and their proportioning—these and similar studies of the central station engineer are doubtless engrossing enough; but nothing of this nature greatly affects the prospects of electric lighting. It is doubtful if the greatest possible achievement of central station engineering could reduce the selling price of the unit by one farthing. Storeage, distribution, and the load factor are the critical points of central station working, to say nothing of financial and commercial considerations. One striking fact brought out by Mr. Crompton was that, so far from lending any assistance to the economical working of an electric light generating station, storeage batteries are a considerable additional expense, while their practical value appears to be very small indeed. How much of this observation on Mr. Crompton's part is true and how much is traceable to the circumstance of his not being in this business, we could not pretend to say.

It was remarked in this column last week that our contemporary the *Engineer* has arrived at the conclusion that central electric light stations must go—out into the manufacturing suburbs. Mr. Gisbert Kapp has had a word to say upon this subject, and upon the reasons that have persuaded our contemporary to its drastic opinion. While he disagrees with some of these, Mr. Kapp nevertheless accepts the conclusion generally; and he regards the position of central lighting stations as calling for the earnest consideration of all electrical engineers. He confesses that such works do not pay well as at present carried on. He has encountered difficulty in arriving at reliable data in this regard; but, after allowing in each case 2½ per cent. for a sinking fund, he finds "the net profits, taken as a percentage on the capital outlay, were last year, in municipal direct current works, 2·43 per cent.; in private works, 3·03 per cent.; and in private alternating current works, 1 per cent." He thinks it very doubtful if the profits of the business will ever become comparable to those of gas supply; and he regards the direct current system as already obsolete. Our contemporary concedes this point in a rejoinder to Mr. Kapp; and he once more repeats the "unpalatable truth" that the existing electric lighting companies in London had better see about extinguishing their intramural fires with the least possible delay, preparatory to moving down to the neighbourhood of Beckton or East Greenwich. *Eheu!* Where is the money to come from?

Dr. John Hopkinson recently delivered the second "James Forrest" lecture before the Institution of Civil Engineers; the subject being "The Relation of Mathematics to Engineering." The matter of the lecture was not such as we could discuss at length in the columns of the JOURNAL; but we are free to admit here that Dr. Hopkinson has made very good use, as an electrician, of the mathematical equipment with which he left Cambridge for London. The lecture, which has been reproduced in many scientific and technical journals, is well worth reading on several accounts, and particularly for the warnings it conveys respecting the improper use of mathematics by half-instructed persons. Better a certain knowledge that two and two make four, than a hazy acquaintance with means of making elaborate computations tending to show that two and two, when taken in conjunction with a guessed quantity, may be regarded as equivalent to five. Electricity has suffered in practice from a superfluity of mathematics; and the manner in which money has been sunk in distributing plant designed by rule-of-thumb, while electricians have been amusing themselves by devising elaborate mathematical formulæ about dynamos, is enough to cause the more practical person to scoff at the collegian.

An instructive insight is afforded into some American business methods by a casual remark, in a paper recently read by Mr. Robert Cartwright before the American Society of Civil Engineers, upon the electric station of the Citizens' Light and Power Company of Rochester, New York. The author incidentally remarks that "the consolidation of the three gas companies and the three electric companies of Rochester (New York) into one organization, known as the Rochester Gas and Electric Company, was effected in 1892. This combination seems to have awakened in the minds of some of Rochester's citizens the old saying that 'competition is the soul of trade,' and hence the birth of the Citizens' Light and Power Company. Some of the stockholders in the different companies sold out their interests when the combination was entered into, and organized an independent company, whose plant, designed and constructed by the writer, is in operation, supplying electricity for light and power." So the game goes on. Six lighting companies compete for business in a small American city, with their six capitals, six administrations, six sets of distributing plant, all cutting one another's throats and their own in the murderous strife after a sixth part of what would not be too much work for one concern. After awhile they awaken to a sense of this truth, and combine their forces. Thereupon a new rival starts into the field; and the amount of business that could not maintain six competitors has to support practically seven. And yet the Americans look upon themselves as being a business people! The whole story of these everlasting competitions, consolidations, "deals," and other means of keeping gas and electric lighting dear in the United States, is one of the most melancholy histories of the way in which a clever community may be deluded, in face of their own ample experience, by a phrase such as that quoted by Mr. Cartwright.

Death of Mr. J. Reed.—The death is announced of Mr. Joseph Reed, Manager of the Newport (I.W.) Gas-Works. The deceased was bordering upon his eightieth year; and he had held his position in connection with the Newport Gas Company for about half his lifetime.

Royal Honours.—Among the honours conferred by Her Majesty on the anniversary of her birthday, we notice that of knighthood upon Mr. John Hutton, Chairman of the London County Council, and Mr. Richard Tangye, of Tangyes Limited, Birmingham. In connection with her recent visit to Manchester to open the Ship Canal, Her Majesty conferred the honour of knighthood upon Alderman W. H. Bailey, the Mayor of Salford, and head of the well-known engineering firm of W. H. Bailey and Co., Limited, of the Albion Works in that town.

THE CASE FOR LOW-GRADE GAS.

It is to be regretted that the time at the disposal of the Institution of Gas Engineers on the occasion of their recent meeting did not admit of the thorough discussion of the question of what is really the best quality of illuminating gas for general use, although the point naturally arose out of the communications of Messrs. J. F. Bell and S. Glover. There is a growing tendency on the part of some gas engineers of eminence in their profession and of good standing in the community to assume the position that this problem is susceptible of but one solution. They say, in so many words, that the best gas for any locality is that which can be made directly from the most convenient kind of coal supply, without enrichment in any way. Thus, since Durham coal is the best available gas-making material for London, the South of England, and many other parts of the world conveniently situated with regard to the seaborne coal trade of the North of England, and since this class of coal can be depended upon to yield a gas of 15-candle power tested upon the works—or (say) 14-candle power tested in the district of supply—then the contention is that this is the best quality of gas, as it will certainly be the cheapest, for sale in the localities referred to. It is further argued that to increase the nominal illuminating power of such a gas by what are called artificial means is a waste of money, inasmuch as every candle power added in any such way to the gas costs far more than it can possibly be worth to the consumer, who, as a matter of fact, has no cognizance of the nominal illuminating power of gas he uses for various purposes, and is indeed quite as likely to complain of getting a poor light when supplied with 25-candle gas as when the article is only rated at one-half this nominal illuminating power.

Indications are not lacking to show that this opinion is making headway in various quarters; but it would be an error to suppose that it meets with universal acceptance, or that the arguments by which it is supported fully cover all the debateable ground. It by no means follows, for instance, that a gas undertaking should be permitted, without question on the side of the public interest, to draw its supplies of coal from the cheapest available source—and this is really what the argument for the "natural supply" comes to. The interest of the public demands that the gas which is now so incontestable a necessary of town life shall be of the best quality that can be produced in the locality at a reasonable price. The only common ground between the gas manufacturer who assumes the position we have mentioned and the public, is that a gas supply should not be a fancy article. The manufacturer has no interest in determining the nominal illuminating power of the gas he supplies, except seeing that price and quality correspond. He will sell 25-candle gas as readily as 14-candle gas, at a price; but he seeks above all other things, in this connection, to arrive at a proper understanding with the public as to the particular quality of gas which is most suitable for a given locality; and he is now beginning to think that a low-quality, low-priced gas is calculated to give most satisfaction to all parties concerned.

One reason for this conclusion lies in the obvious fact that the higher the standard of illuminating power imposed upon the gas manufacture, the smaller the range of possible coal supplies to which he is confined, at any rate in England. This remark, of course, applies only to coal gas; for carburetted water gas may be made of almost any desired richness without materially enhancing the cost of the article. It was seen last summer and autumn, in connection with the coal miners' strike, how difficult it sometimes is to obtain gas coal capable of producing even an 18 or 20 candle gas. Yet 18 or 20 candle gas may, in ordinary circumstances, be the natural quality of gas in some localities, just as 25 or 27 candle gas is at the present time in parts of Scotland where cannel is the common coal of the country-side. The problem that has to be solved (of which is the best gas for any given locality) is therefore not quite the same as that of which is the best gas of all the different grades that are sold in the world to-day, or even in the United Kingdom. Yet the consideration of the latter problem throws some light upon the former. For let it be assumed, for the sake of the argument, that 20-candle gas is agreed to be the best made, it would then come to be a question whether the superiority of this gas to the 15, 16, or 18 candle gas sold in a particular district could be held to be such as to warrant taxing the district with the extra cost of the ideal article. If this extra cost did not happen to be prohibitive, there would be a strong case for making the sacrifice.

Mr. Glover argues, as we understand him, from the point of view of the photometrist when he gives the palm to 20-candle gas, which is the higher Lancashire standard. The argument runs as follows: The greater part of the gas used by the public for illuminating purposes is burnt by means of flat-flame burners. For all gas rated under 20-candle power, the testing-burner is an Argand, which indicates a higher illuminating power than does the flat-flame burner, the comparative efficiency of which falls off directly with lowering of the quality of the gas. On the other hand, the higher the quality of the gas, the better becomes the duty of the flat-flame burner, until at the 20-candle standard and upwards it arrives at an equality with the Argand, which accordingly ceases to be the testing burner. So that with gas at the 20-candle standard the public actually get what they are supposed to get in the matter of illuminating power; the testing-burner being the same as that which is in most general use by the poorest gas consumers. This argument is more than plausible—it is really good; and it is by far the best excuse for carburetting a 15 or 16 candle gas up to 18 or 20 candle power that has yet been advanced. Indeed, at the first blush, it appears to be completely subversive of the position of those engineers who would have it that 15-candle gas is the best for London.

Giving the argument all the weight which is its due, however, it is far from being able to stand a critical attack. In the first place, wherever the 20-candle standard has to be attained by carburetting—and there is very little of such gas made in England without this adventitious improvement—it must cost from 6d. to 10d. per 1000 cubic feet more than a 15 or 16 candle gas produced in the same place. If the consumer of the gas for lighting purposes by means of flat-flame burners regards this higher cost as a fair price to pay for the superior efficiency of his burners, the users of gas-stoves and gas-engines are not commensurately recouped. With regard to the uses of the flat-flame burner, the issue is as broad as it is long. If he is supplied with a 15-candle gas, his flat-flame burner will deprive him of 25 per cent. of light. Raise the standard to 20 candles, and he gets full duty from his burner, but has to pay 25 per cent. more for the gas. We do not put this statement forward as applying rigidly to the circumstances of any particular district; but the general principle is here fairly expressed.

And more—the moment we drop the flat-flame burner, the superiority of 20-candle gas to 15-candle gas begins to shrink. We have hitherto given the flat-flame burner all that is claimed for it as a means of consuming 20-candle gas, and said nothing of the sooty ceilings which so commonly betray the incompetence of such burners to deal with the rich material supplied to them. This feature, however, must not be overlooked, since it supplies another reason, besides that of economy, for the preference consumers of rich gas show for small burners. The richer the gas, the smaller the burner. The smaller the burner, the more meagre the flame; and the poorer the general effect of the lighting. This consideration brings us back to an observation with which we started this article—the common discontent of the consumer with nominally high-qualify gas. He wants a "good light;" he neither knows nor does he care what standard photometrists employ to indicate the nominal illuminating power of a gas. All he knows is that he cannot get so good a light, or so bright an effect, from the small burners which the smokiness of a highly-carburetted gas compels him to use, as can the luckier consumers of gas sold elsewhere at little more than half of the rate he is asked to pay.

Gas engineers need continually reminding that their terms of "rich" or "poor" gas are mere conventions, and have no meaning to the consumer, whose sole desire is for a "good light." Now, a good light is only to be had from light which is diffused; and diffusion is the effect of luminous sources of considerable area and mild brilliancy. The most successful experiments in the diffusion of light from small, brilliant gas-flames are those of the albo-carbon clusters; but the good people who have rich cannel gas supplied to them at home do not go in for this kind of thing. A single No. 1 union-jet burner in a sitting-room is more in their style; and how dismal is the effect of such so-called lighting! It is superfluous to ask whether Paris or Edinburgh is the better-lit city. Yet a gas engineer would say that the Edinburgh gas is twice as good as that of Paris; and he would be apt to think that when he had said this he had said all. Again, the gas engineer is very prone to laugh at the misguided inventor who comes to him with some wonderful device for removing the "blacks" from illuminating gas; but it might be asked whether, after all, the innocent inventor is not in the right of it, and why these "blacks" are so diligently prepared at enormous expense for an unappreciative public. There is an impression in the minds of some gas engineers that gas of a high illuminating power is better fitted to withstand the competition of the electric light than gas of nominally low grade. We believe that this is a mistake. It originated in the United States, where it suited the purpose of the water-gas men to bring this point into prominence; but the low-grade coal gas of European towns, aided by the incandescent gas-burner, has held its own against the electric light quite as well as, and perhaps better than, American water gas. Finally, the consideration of cost must settle the question. If it cost no more to make gas of 20 candle power than it does to produce gas of 15-candle power according to the photometer, the problem of which is the preferable product might still be unsolved. But seeing that, as things go, the balance of economy is in most places heavily in favour of the latter standard, the case for the more expensive compound becomes desperately hard to prove.

Midland Association of Gas Managers.—The spring meeting of this Association will be held at Cheltenham next Thursday, under the presidency of Mr. R. O. Paterson. We learn, from the circular issued by the Honorary Secretary (Mr. C. Meiklejohn, of Rugby), that the actual business will be little more than routine; but it will include an inspection of the gas-works under the guidance of the President. After this, the members will go for a drive over the Cotswold Hills to Birdlip, where dinner will be provided at the George Hotel by the Directors of the Cheltenham Gas Company.

NOTES.

Tests of Transparency.

According to a paper published in the *Journal für Praktische Chemie*, the author has made some experiments upon the determination of the transparency of different media by means of Crookes's radiometer. With this object, he first investigated a method of ascertaining accurately the rate of rotation of the vanes of the radiometer. The instrument was enclosed for this purpose in a metal case, blackened on the inside, and open in the direction of the radiant rays. This case was provided with a side tube, through which the observer could see the vanes rotating. When a rotating vane came into a certain position with relation to the source of light and the eye of the observer, a flash of light was seen. By means of a chromascope, the instant at which this flash occurred was noted. A convenient number of transits of the vanes were observed and counted; and the time occupied was again determined by the aid of the chromascope. The method is susceptible of a considerable degree of accuracy; and it was first employed in experimentally testing the action of the radiometer when the instrument was first at a distance of 20 centimetres from the source of light, and secondly at twice the distance. In three successive experiments, the ratio of the numbers representing the revolutions of the vanes was found to be 3·95, 3·99, and 4, which is exceedingly near the theoretical value as given by the law of radiation. In endeavouring to measure the transparency, or the diaphaneity of bodies, the author used a couple of radiometers exposed to the same source of light, and adjusted to revolve at the same rate of speed. The plate or solution to be examined was then introduced in front of one of them; and by readjusting the distances the rates of revolution could again be equalized. The diaphaneity of water being taken as unity, it was found in this way that saturated aqueous solutions exhibit only slight differences in diaphaneity. The addition of sodium chloride increased it by 3·75 per cent., while oxalic acid lowered it to 98·79 per cent.; but nothing else made so much difference. The diaphaneity of carbon bisulphide, 141·70, exceeds that of glass, which is 140·77; and it is noted that carbon tetrachloride, which has the index 145·77, is more diaphanous than air, which stands at 142·26 in the same scale.

The Best Temperature for Gas Producers.

Herr R. Ernst has been experimenting with a view to ascertaining the conditions under which producer gas is made from air and carbon. Coke was coarsely powdered, free from dust by sifting, and roasted at a very high temperature in a Hessian crucible to remove hydrocarbons. It was then burnt in a current of air passing through a porcelain tube heated in an ordinary combustion furnace; and the resultant gases were arrested and analyzed. The temperature of the interior of the tube was checked during the experiments by means of a Le Chatelier pyrometer. The length of the layer of coke, the rate of passage of the air, and the temperature, were independently varied in the experiments. As a general result, it was found that the composition of the gaseous products of combustion depended almost entirely upon the temperature at which the operation was effected. The formation of carbonic oxide and carbonic acid began at about 400° C.; the production of the latter increasing rapidly up to 700° C., when it constitutes about 20 per cent. of the gases collected. The amount of carbonic oxide at this temperature is still small; being only about 3 per cent. of the total. With a further rise of temperature, however, the proportion of carbonic oxide increases at the expense of the carbonic acid, until at 1000° C., it forms one-third of the gases; the bulk of the remainder being nitrogen from the air. It was shown that at this temperature combustion results in the direct production of carbonic oxide, for the usual process of the reduction of the carbonic acid to carbonic oxide could not be completely carried out under the conditions of the experiment. It is the author's conclusion from this that, since carbonic oxide is the only oxidation product at 1000° C., generator gas should always be made at this temperature. The experiments are held to explain why carbon burns at a moderate heat without flame, but shows a flame at a brighter heat.

The London County Council and the Water Supply.—At the meeting of the County Council to-day, a report will be presented by the Water Committee, stating that, under their instructions, the Engineer (Mr. A. R. Binnie) is preparing a report on the site and yield of sources of water supply outside the Thames Valley, and on the method which might be adopted for storing and conveying water to London. To enable the Engineer to carry out these instructions, it is said to be necessary that he should have assistance; and he has asked permission to retain the services of Mr. Richard Hassard, Mr. G. F. Deacon, and Mr. G. J. Symons. As time pressed, the Committee took upon themselves the responsibility of authorizing the Engineer to retain the assistance of these gentlemen; and the Council are asked to approve the course so taken. It is mentioned that Mr. Hassard has devoted much time and consideration to the water supply of London; and, with the late Mr. Hemans, he laid before the Royal Commission of 1869 a scheme for the supply of London from the Cumberland lakes. He has also more recently formulated a proposal for obtaining a supply from Wales.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Visit to the Manchester Ship Canal.

The Ninety-eighth Quarterly Meeting of the members of this Institution, held last Saturday afternoon, took the form of a trip on the Manchester Ship Canal. While the canal was in course of construction, it was visited by the members and their friends; and it was thought they would like to renew acquaintance with it now that the steam-navvies have done their work, and the great cutting, filled with water from end to end, has been thrown open to the ships of all nations. That the thought was generally regarded as a happy one, was indicated by the dimensions of the gathering. Instead of the sixty or seventy who had been expected, the attendance totalled up to close upon a hundred and twenty; and among those present were a considerable number of ladies. The S.S. *Eagle*, with this large party on board, left Trafford Wharf shortly after eleven o'clock; and, in spite of the heavy showers of rain, the voyage along the water-way was much enjoyed. On all hands one heard expressions of admiration of the financial and engineering energy and enterprise which have, by means of the canal, made Manchester into an inland port. It is apparent, however, that much yet remains to be done before the canal is thoroughly equipped for its work; and one can well believe the statement published in the Manchester papers yesterday (Monday) morning, that an expenditure of something like a million of money is "most urgently required and absolutely essential for traffic now being negotiated for and in course of development." And, when all is done, there is the further important question of whether the canal will attract to it all the traffic that its promoters anticipated. That the shareholders themselves are not over-sanguine on this point, appears to be indicated by the circumstance that the £10 ordinary shares are to-day selling at from £2 to £3.

In the course of the passage along the canal, luncheon was served; and a little later the members assembled in the saloon to transact what little formal business there was on the *agenda*. Before entering upon this, Mr. J. Braddock, of Radcliffe, the President of the Institution, who occupied the chair, referred to the death since the last meeting of Mr. John Hutchinson, of Barnsley. Mr. Hutchinson, he said, was one of the earliest members of the Institution, having been elected in the very first year of its existence. At a later period in its history, he became its President. He (Mr. Braddock) would not attempt to refer to the many excellent qualities which endeared Mr. Hutchinson to the members—qualities which were well known to all of them. He felt sure they were one and all the better for having known such a man. He thought it would be in consonance with their feelings that some record of Mr. Hutchinson's death should appear in their proceedings; and he therefore begged to move—"That the members of this Institution record with deep regret the death of their esteemed Past-President, Mr. John Hutchinson, of Barnsley, and tender to the family sincerest sympathy." The Vice-President (Mr. G. Smedley, of Buxton) seconded the motion. He said he had known Mr. Hutchinson for so many years, that he felt almost as a brother to him; and, indeed, in some senses he was one. He was a man whom to know was to respect—a man whose word could always be depended upon, and whose geniality earned for him the regard and esteem of all who knew him. Now that he had gone to that bourne to which they must all, sooner or later, follow him, he felt sure they would all cordially join in the motion expressing sympathy with his family. The members signified their approval of the motion by rising. The minutes of the previous meeting were then read by the Honorary Secretary (Mr. S. S. Mellor, of Northwich), and they were adopted, on the motion of the President, seconded by Mr. W. H. Gendall (Bury). Two new members were proposed for election—viz., Mr. C. A. Craven (Dewsbury) and Mr. Walter R. Herring (Huddersfield). On the motion of Mr. J. Parkinson (Brighouse), seconded by Mr. R. Porter (Elland), Mr. Craven was elected, or rather re-elected, for he was formerly a member; and Mr. Herring was elected on the motion of Mr. C. Armitage (Lancaster), seconded by Mr. J. Furniss (Slaithwaite). There was no further business to transact beyond the reading of letters of apology from some members who were unable to attend.

In consequence of the stoppages at the locks, the voyage along the canal occupied something like five hours; and it was just after four o'clock when the Prince's Landing-Stage, Liverpool, was reached. On arrival, tea was served at the Bear's Paw Hotel, Lord Street. This over, the proceedings were brought to a close with a well-deserved vote of thanks to the Committee and the Honorary Secretary, for their admirable arrangements, and a few remarks from Mr. John West, President of The Gas Institute, descriptive of the programme for the coming meeting of that body.

Mr. T. M. Walsh, the Manager of the Mallow Gas-Works, has been appointed to a more important position in the Tuam (Co. Galway) Gas-Works, and entered upon his duties last week.

OHIO (U.S.A.) GASLIGHT ASSOCIATION.

(*Concluded from p. 964.*)

A paper on "The Joint Business of Gas and Electric Light" was read by Dr. Howard Jones, of Circleville. He said that, particularly in small towns, the gas and electric interests should be combined, as they could be worked more profitably in this way than as separate undertakings. When electric lighting was first introduced, the public generally formed a very exaggerated estimate of its commercial future; but they now found that it must be very carefully worked if money was to be earned by it. Circleville was a town of 7000 inhabitants. Gas was established there in 1859, and did a good business. At first the price was 20s. 10d. per 1000 cubic feet. But it was gradually reduced; and in 1885 it stood at 10s. 5d., and the company were paying good dividends. In 1886, the Edison incandescent electric light was introduced with flying colours—a 50 per cent. dividend being promised. Active competition then began. The price of gas was reduced to 4s. 2d., which was a losing figure; and in two years the Electric Company spent £11,000. In 1888, an agreement was effected; the price of gas being raised to 8s. 4d., and that of the electric light in similar proportion. This arrangement admitted of profits being earned in each case. In 1891, the public lighting contract expired. Arc lighting was demanded; and, after a great deal of wrangling, the Gas Company obtained the contract to supply 119 arc lights, each of 1200-candle power, for ten years, at a price of £15 per lamp per annum. They at once put down plant, and also commenced the supply of incandescent lights. They reduced the price of gas to 6s. 3d., with a sliding-scale of discounts ranging to 50 per cent. Soon afterwards, they bought up the Electric Light Company; and at present the whole concern was under one control. The result was satisfactory. While the sales of gas were good, they were doing well with incandescent lights. These were supplied at 6s. 8d. per 10,000 watts (10d. per unit), which was about 10 per cent. more than the price of gas. They had 200 electric services, supplying 2100 lights, and 300 gas services; but the profit on the electric light was not sufficient. It was, in fact, only half that earned by the gas. They used the Fort Wayne arc system, running three 50-arc machines, and Wood double-rachet arc lamps. There were three circuits, representing a total length of nearly 20 miles. This installation had given perfect satisfaction in working; and it earned a profit equal to that derived from the gas. Worked as a separate venture, however, it would be a loss. It ran about 2500 hours a year. Each lamp consumed 1-horse power per hour; and 5 lbs. of coal were used per horse power. He estimated the cost as a separate concern as follows:—

Coal	£137
Carbons, water, taxes, and insurance	224
Salaries and wages	760
Wear and tear, 5 per cent. of cost	300
Total	£1421

The income was £1785, and the capital invested was £6000; so that, after allowing for contingencies, &c., there was not a large profit. But when worked in combination, several of the items, particularly that of "Salaries and wages," were largely reduced, and a saving of at least £100 was effected. The system of 2100 incandescent lights, which carried a maximum load of 400 ampères, produced an income of £1200; and the working expenses, as a separate concern, were £1056—leaving a profit of less than 3 per cent. on the capital of £5000. In actual working in combination, however, it yielded more than 4 per cent. It was sometimes urged that there was no profit in electric lighting; and therefore the gas companies would do well to leave it alone. It was true that there were at present only a few successful electric undertakings; but this state of things would not continue. The prospects would improve. Sold at one-fourth advance in price as compared with gas, electricity would yield as good profits. The electric plant caused much less trouble, and required less skill and care in working, than gas plant.

Mr. Wilkiemeyer was the first speaker in the discussion; and he argued that the Circleville Company were working too cheaply. Their plant was now, he said, modern and new; but how would it do when it became old and behind the times? There should also be a reserve in the bank; for no one was safe from opposition, or from the question of municipal control. If a fair allowance under the head of depreciation was added to the figures in the paper—say, 10 per cent., which, in his experience, was not too much—there would be no profit at all, but a loss. Large allowances for depreciation of capital had been necessary in many cases. Some of the stock in electric lighting companies was not worth one-half, or even one-third, its "face" value. This depreciation was the price of experience and improvements; and it was a substantial factor that would have to be reckoned with. He could not agree that electricity was less troublesome, or required less vigilance, than gas. He knew many who had tried the combination; but few were satisfied. On the other hand, many were doing well with gas alone. In spite of popular report, their sales increased year by year. It seemed to him that the only thing yielding a proper return at Circleville was the gas, and that, with regard to the other illuminant, Dr. Jones was depending too much on Providence for his dividends. Mr. Cantine thought that the figures given in the paper were fair, and that the previous speaker took too gloomy a view of the position. If Mr. Wilkiemeyer's views were correct, very few of their undertakings were in a sound state. Mr. Nash said that one of the chief causes of loss on the electric light was the action of the manufacturers themselves. If they would leave a district alone after supplying a plant, there might be a chance to make the thing pay. But the usual custom was to try to get in a second set of plant—perhaps a municipal one—which meant opposition and loss. Dr. Jones had cut his figures very finely, and had reckoned nothing for opposition. He agreed that 10 per cent. was not too high a figure for depreciation. The author of the paper evidently enjoyed favourable circumstances at present, and had been successful above the average. Mr. M'Donald held that gas companies must not lull themselves into security because their competitors were losing money. Some 25 years elapsed between the organization of the first gas company and the payment of the first dividend. Practical experience led to large reductions in the price of gas; and it would do the same for the newer illuminant. Electricity would become an important competitor with gas; and he thought those gas companies who were taking it up, even at some loss, were acting wisely. Mr. Miller said there was the fact that the electrical business at Circleville had already grown to two-thirds that of the gas; but he did not agree with the idea that electricity was commercially only in its infancy. It had come to a full age; and the best authorities admitted that there was but little room for further improvement. Mr. Allen said that, if electricity moved forward, gas would not stand still. If a little advance was made in electricity, it was largely advertised, and made much of. Gas people went on without much talk or show; but none the less they were continually improving. Mr. Gwynn said that one-third of the gas companies were now operating electric works, so that papers of the kind now under discussion were acceptable. Dr. Jones evidently had no telephone, telegraph, or fire-alarm wires in his district. The general experience was decidedly in support of the fact that electricity called for more care and vigilance than gas; and he would rather handle three gas-works than one electric lighting plant. Dr. Jones had been fortunate in securing the city contract on better terms than most of them could get. Many companies were compelled to furnish 2000-candle power lamps for 4000 hours per annum for a similar, or even a less price; so that, according to the figures in the paper, many undertakings were running at a loss. He thought depreciation should be put at not less than 7 to 8 per cent. Mr. Gwynn remarked that out of the 2300 electric light companies in the country, not 100 could show a dividend.

Dr. Jones, on being invited to reply, said his figures were not estimates, but were based upon practical results. He knew for a fact that an electric plant did not require entire renewal every ten years, because he had run one for this period. The life of the plant would depend upon several conditions, such for instance as climatic influences, and the care bestowed upon its use and maintenance. Several of the speakers had not reached the bottom of the electric light business. In his opinion, electrical apparatus was as fully developed in practice as gas; and therefore the chances of improvement in the future were even. He was more of a gas man than an electrician; and the gas department had not been neglected. In 1885, the output was about 5 millions; but during the last ten years, notwithstanding the electric light, it had gradually risen to 10 millions. It would be all very well to keep to gas if this would satisfy the public; but electric light was wanted, and they would have it. The secret of success with electric lighting was thorough efficiency; and much of the trouble which had been hinted at was due to carelessness or inefficiency. In a few years he expected electricity would be as largely used as gas; and when this happened it would pay as well. He had laid the results of his experience before the meeting, and did not draw inferences as to what could or what could not be done at other places.

A paper on "Gas for Fuel" was submitted by Mr. Donald M'Donald, who said he did not believe in cheap inferior gases, but that the fuel gas of the future, if ever there was one, would be of comparatively high quality. The competition of electric lighting, and the gradual failing of the supplies of natural gas, led gas companies to search for other outlets for their product, and communities to look for some form of gaseous fuel, while natural gas companies wanted some means of assisting the natural product at the busy season. The supply of gas that was ample in June was not sufficient in December; and therefore it paid to provide an auxiliary supply, even at a loss, to tide over December and January, and retain as many customers as possible throughout the year. Fuel gas had suffered from the ignorant pretensions of process-mongers, and from want of knowledge as to the proper ways of using gas for such purposes. With gas at about 4s. per 1000 cubic feet, it was economical for cooking, and also for intermittent, but not for continuous, heating. At 2s. per 1000 cubic feet, gas cost more than coal, but still would be very generally used as a domestic fuel, on account of the convenience. Gas at 1s. 6d. per 1000 feet, yielding (say) 700 heat units per cubic foot, would compete with anthracite at 33s., or soft coal at 15s. per ton. Where materials were cheap and conditions favourable, ordinary illuminating gas could be supplied on the large scale at about this price, and the business would be profitable. Gas at 2s. per 1000 cubic feet was certainly an economical agent for warming

rooms, if the products of combustion were prevented from escaping; but fuel gas for general use must admit of good ventilation. An unventilated stove might be employed in a hall, or for a few minutes while dressing in the morning, without causing any bad effect. The deleterious influence of gas was, in his opinion, a little overdone. It was generally said that 13 parts of carbonic acid in 10,000 parts of air rendered the latter unfit to breathe; but he had worked for hours in a room in which the proportion of carbonic acid had been purposely raised to 15 parts per 10,000 by burning gas, without suffering the slightest inconvenience. The weight of 100 cubic feet of natural gas was 4·29 lbs., and it contained 1·07 lbs. of hydrogen and 3·22 lbs. of carbon. It required 969 cubic feet, or 74·6 lbs., of air for its combustion. The products of combustion were 9·6 lbs. of steam and 11·79 lbs. of carbonic acid; and the heat produced was 94,593 units. If the products of combustion escaped at a temperature of 300°, they would take away less than 7 per cent. of the total heat; but if an excess of air was used, the loss would be increased in proportion. A room 16 ft. by 16 ft. by 12 ft. could be raised from 30° to 70° in temperature with only 3 cubic feet of gas per hour, assuming perfect combustion and no other loss than that of the actual products of combustion escaping at 300°. If the air was changed three times per hour, the consumption would be only 9 cubic feet. The author constructed a small apparatus on the principles thus indicated; and he found that, with a consumption of 13 cubic feet per hour, a temperature 30° to 40° above that of the outside air could be maintained, and this with perfect ventilation. But he was surprised to find that, in all ventilating gas-stoves he had seen, no attempt was made to separate the products of combustion from a surplus of air. Consequently, the gas consumer had to choose between no ventilation or an extravagant bill. Attention was next directed to the question of the cheapest price at which good gas—say, 18-candle power—could be profitably supplied for fuel purposes; and the author argued that the direction in which to look for cheap gas was the complete gasification of soft coal by a generator process. He described an apparatus used at Louisville; and he claimed that it was a successful attempt to combine a water-gas with a coal-gas plant. It was used as an auxiliary to the supply of natural gas. If the existing gas companies did not direct their attention to the demand for fuel gas, others would come into existence, and take up this line of business.

The paper was followed by an animated discussion, which mostly took the form of questions. Mr. M'Donald, in reply, said that no tar or soot was formed in the apparatus he had described. He admitted that people would not pay twice as much for the same quality of gas, if used for lighting, than if it was employed for fuel, and that they would have to come to one even rate. The demand for fuel gas would be proportionately very large. His average annual income was £16 per meter. The cost of his fuel gas, made as described above, was about 9d. per 1000 cubic feet; and it could be distributed for another 1d. per 1000 feet. The pressure at which he distributed natural gas was 8 inches. The direction in which to work for the increase in the demand for fuel gas was to instruct the consumers. His experimental stove was strictly in accordance with theory. He simply aimed at taking away the products of combustion with the least possible loss of heat.

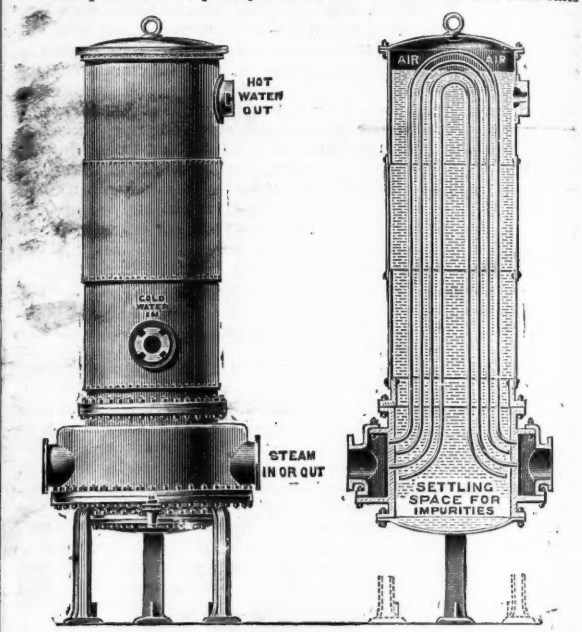
Attention was then directed to the "Question-Box." In reply to a request for information as to the best means of preventing the destruction of gas service-pipes by electrolysis, Mr. Kelly, Superintendent of the Columbus Street Railway Company, said that rails of ample section, welded at the joints, would prove a good remedy. The double trolley system would lead to complications which they did not care to encounter. The matter was quite as important to the railway as to the gas companies, for the return of electricity by indirect paths was attended with great waste. No doubt the character of the soil had much to do with the trouble. The presence of salt water, for instance, always aggravated the difficulty. An animated discussion followed the question "Does not the use of stopcock boxes on services entail a large expense, without compensating advantages?" Although some difference of opinion prevailed, a good case for an affirmative reply was made out. In answer to the query "What advantages has gas over other forms of artificial light?" the members agreed that it was economical, convenient, reliable, safe, adjustable, and possessed greater diffusion. As to the best means of enriching in a small works, Mr. M'Ilhenny spoke highly of the plan of injecting naphtha into an ordinary coal-gas retort during the last hour of the charge.

The meeting then closed.

Presentations to Officials of the Langbank Gas Company.—The recent completion of a quarter of a century in the existence of the Langbank Gas Company was celebrated by a dinner in the picture gallery of Sunnyoaks Hall, the residence of the Chairman (Mr. T. B. Seath). The toast of the evening—"The Langbank Gas Company"—was proposed by Mr. Cross, who coupled with it the name of the Chairman. In responding, Mr. Seath alluded to the benefit which gas lighting had proved to Langbank. He was then presented with an illuminated address, the gift of his co-Directors; and subsequently, when proposing the health of the Secretary (Mr. Duncan), Manager (Mr. Renfrew), and Auditor (Mr. Gilchrist), he presented each of these gentlemen with a gold scarf-pin.

BROWN'S PATENT "BERRYMAN" FEED-WATER HEATER.

The apparatus which is illustrated herewith constitutes an indispensable adjunct to all steam-power plants, especially when the feed water is of such a character as tends to the formation of hard or soft scale in the boiler. The original Berryman appliance has come into extended use in all parts of the world, on account of its undoubted merits—saving fuel and arresting impurities that would otherwise settle in the boiler. But it had its faults, the principal of which was the way in which the steam-pipes were disposed in relation to the space provided for the reception of the precipitated scale. The dirt and lime salts



collected round the tubes themselves, and not only prevented them from performing their office, but became caked by the heat, and rendered the necessary periodical cleaning operation tedious and troublesome, as well as expensive. In order to try and remedy this defect, Mr. C. J. Brown, the inventor of the improved Berryman heater, has arranged the heating-tubes in such a manner that all sediment shall fall clear of them, and collect upon the dished bottom cover, which is easily detachable; and when lowered, and resting upon the projections formed on the feet to receive it, free access is given to the inside. The top cover also takes off; and there is then a clear way through the apparatus for brushing the tubes. No steam connections need be broken for the purpose of cleaning; and the tubes, which are of solid drawn brass, are free to expand and contract with the variations of temperature, and are consequently less liable to become coated with hard scale. The whole thing is very compact, and not of expensive construction.

A LARGE METAL WATER RESERVOIR.

A recent issue of the *Génie Civil* contained an illustrated description of a covered iron reservoir constructed in connection with the water-w orks at Bordeaux. A condensed account of the work lately appeared in the *Engineering Record;* and the following particulars are extracted therefrom. At the reservoir site the soil is a compressible, permeable, and unstable one. It is composed of a top layer of peat and black mud 20 feet thick overlying some 40 or 50 feet of sand above the bed rock—circumstances which were considered to imperatively call for the use of pile foundations with concrete caps. The city service required a capacity of 660,000 gallons, placed at a level about 10 feet above the ground; and the head of the supply limited the depth of the reservoir above this plane to 6 ft. 6 in. These conditions determined the superficial area of 1955 square yards for the reservoir. To avoid extensive pile-driving, it was decided not to build a masonry reservoir, or a metallic one on masonry walls; and a design was adopted of walled metal work on cast-iron columns. The reservoir is essentially composed of two adjacent tanks about 55 feet wide, 131 feet long, and 6 ft. 6 in. deep, with rounded ends, and each having independent connections for filling, emptying, and overflow, so that either one can be repaired or emptied without interrupting the use of the other. The exterior longitudinal walls of the tanks are in panels of about 13 feet; each of them being composed of a segment of the surface of a vertical cylinder of 23 feet radius. The convex side is outwards, so that the metal is in tensile strain, and is 0·15 inch thick. The partition wall between the two tanks is 0·3 inch thick, and is stiffened with angle-iron. The vertical sides are braced by frames connecting the partition and the I-posts of the outer

walls. The bottom is flat, and is of sheet iron about 0·2 inch thick, supported on 8-inch I-beams 17 feet from centre to centre, which are carried by eleven 31-feet girders 18·4 feet long and 13 feet apart, which cap 77 hollow cast-iron columns 9·8 inches in diameter, 1·2 inches thick, and about 13 feet high. Each is set upon a cut-stone cap 39 inches square, with concrete base 5 ft. 6 in. by 5 ft. 6 in. by 36 in., supported by five piles from 30 to 40 feet long. The columns have bases 2·3 feet high, proportioned for stability under a wind pressure of 35 lbs. per square foot, and adjusted to position upon four ¼-inch oak wedges, the space between which was filled with cement to secure uniform bearing. Between the bottom of the tanks and the supporting girders 6000 cast-iron shoes, 19 in. by 19 in. by 19 in. are interposed, which are removable to permit riveting and painting. The roof is supported on trusses of about 56-feet span, the lower chords of which carry a wooden platform which covers the tanks for the exclusion of dust and protection from changes in temperature. The exterior walls are about 3 feet from the sides of the tanks, and are made of coloured brick in iron panel frames. There are 24 windows; and the roof is made of Marseilles tile laid on wooden lath. The maximum column load is 24,000 lbs. The total weight of metal is 80 tons of cast and 320 tons of wrought iron; and the total cost was about £7800. M. Gérard, the City Engineer of Bordeaux, directed the work during its progress.

TESTING PORTLAND CEMENT.

A useful contribution to the somewhat scattered literature bearing on Portland cement was presented to the London Section of the Society of Chemical Industry on the 7th inst., by Messrs. W. H. Stanger, M.Inst.C.E., and Bertram Blount, F.I.C. The occasional failures, from no very obvious causes, of hydraulic cements employed in costly engineering work, warrant the attention now more generally given to the mechanical and chemical tests. The authors enumerated the steps in the examination of a sample of Portland cement in a convenient order, naturally beginning with the determination of its fineness. All particles that remain on a sieve of 76 meshes per linear inch are wholly inert; and the authors agree that "not more than 10 per cent." of such particles in a cement is a none too stringent requirement. They would, indeed, add to specifications a further clause requiring a certain considerable portion of the cement to pass a sieve of 160 meshes per linear inch. For further fractionating the finer particles, where necessary, elutriation with dried turpentine or light mineral oil is proposed as a substitute for sifting. Weight per bushel is no longer a sure indication of the quality of cement, unless the fineness be at the same time regarded; and for laboratory tests the determination of specific gravity is considered preferable. An improved apparatus has been devised by Mr. Blount for this determination; and it may fairly be expected to replace the unstable Schumann and other early forms of volumenometer for the purpose. The specific gravity of good freshly-ground Portland cement should not be less than 3·15; but, on exposure of the cement in a thin layer, aëration may cause the specific gravity to fall to 3·10 or even less.

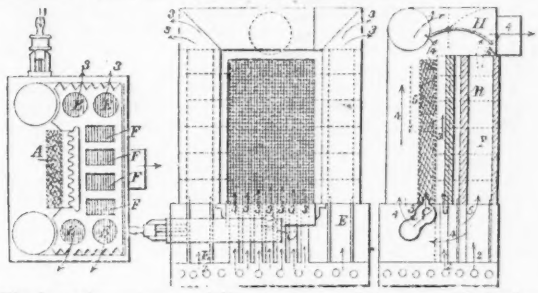
The time of setting of most cements is lengthened by keeping, and by low temperature. For tests of strength in tension, the use of neat cement is condemned, and an admixture of at least three times its quantity of sand advocated. The use of hot tests of the soundness of cement is defensible, if they are carried out on a definite system such as that initiated by Deval, who found seven days' exposure in water at a uniform temperature of 80° C. equivalent, for normal hydraulic cements, to 28 days at the ordinary temperature. Results of a number of hot and cold tests made for the purpose of comparison in the authors' laboratory showed that few Thames and Medway cements stood the hot tests unless they had been previously aërated, owing to the presence of unsaturated base ("free lime"). The hot test is especially useful in determining the quality of raw materials for cement making, and, applied to samples of cement made in the laboratory, proves that a percentage of lime that would be regarded as excessive in cement made on the large scale is compatible with perfect strength and soundness in one burnt with the thoroughness possible in the laboratory. Hence it may be conceded that uneven and defective burning is an important cause of imperfection in commercial cement. Having regard to the circumstances under which the bath for the Deval tests may be required to work, the use of a thermostat is inadvisable; and the authors have devised a water bath capable of maintaining an inner bath at a uniform temperature of 80° C. without regulation of the gas supply or other source of heat. Water is kept boiling in the outer bath; and the intervening space is of such dimensions that radiation from the inner walls of the outer bath exactly suffices to keep the inner bath at the desired uniform temperature. This temperature is practically constant, provided the water in the outer bath continues to boil. This method of maintaining a bath at uniform temperature is useful for many other purposes. The paper concluded with some hints on the chemical analysis of cement.

In the discussion following the paper, Messrs. Reid, Bernays, and Matthews supported the main contentions of the authors.

REGISTER OF PATENTS.

Gas Heating Apparatus.—Browne, A.; a communication from Joseph Danischevski, of Paris. No 9653; May 13, 1893.

This invention consists of means by which, according to the patentee's claim, he can "utilize simultaneously the incandescence and radiation of the material on which the flames act." The invention is based upon "a special application of asbestos fibres, coated (or not) with metallic oxides of magnesium, calcium, zirconium, or others, for the purpose of immediately giving heat by utilizing the combustible gas."



The incandescent mass of fibre is supported by a metallic basket A, of large mesh, on which is fixed trellis work B, made of asbestos fibres. This support is of rectangular form; and in order to increase the incandescence of the asbestos, these cross the support from one end to the other. The passage of the combustible gas is indicated in the drawing by the arrow 1, arriving at the burner C, of any suitable form. The air enters at the base; the arrows 2 indicating its passage. A part of the air gets hot, and passes out by the tubes E. The rest of the air circulates through the tubular arrangement shown, thus heating and increasing the incandescence; and subsequently the products of combustion circulate by the special tubes or flues F, and escape by the chimney. Arrows 4 indicate the circulation of the gases or heated air. The register H fixed at the top compels the heated air to redescend by the flues F, and to return by the outside of the apparatus to the chimney. In arranging a register, as represented by the dotted lines, the gas can be made to travel in an inverse direction, as indicated by the dotted arrows 5.

Prepayment Gas-Meters.—Price, W. E., of Hampton. No. 11,185; June 7, 1893.

This invention relates to cash-receiving mechanism in gas-meters such as are described in patent No. 164 of 1889; and it consists in an arrangement by which pennies may be used to pay for the gas (instead of shillings), and so that a number of pennies may be inserted immediately one after the other, to be fed by the mechanism one by one, as they are wanted, on to the lower arm of the coin-lever, so as to keep the supply of gas on until the whole quantity paid for by the pennies inserted has been consumed. The mechanism of the disc and levers and pin does not differ, except in matters of detail, from that described in the 1889 patent, but the coin-receiving apparatus is different.

Fig 1.

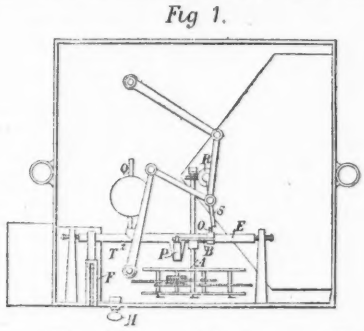


Fig 2 *Fig 3* *Fig 4*

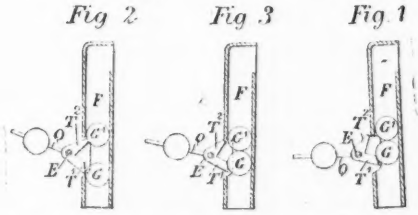


Fig. 1 is a plan of a meter fitted with the new apparatus. Figs. 2, 3, and 4 show the positions of the coin-lever and coins at various stages.

A is a horizontal shaft, or spindle, carrying the pointer of the upper dial, and the disc B. S is an arm mounted on, and revolving with, the vertical spindle carrying the tangent screw R, and which is connected with, and driven by, the bellows of the meter by arms and links in the usual manner. F is the coin-shoot, having an opening through which the coins are inserted. E is a spindle, carrying various arms, operated by the coins, the movements of which are controlled and regulated by the lever. Q is an arm carrying a weight; P is an arm carrying a pin operated by the disc B; and O is an arm which, when the flow of gas is to be arrested, moves into the path of the arm S, and stops it. G G¹ are pennies; and H is a knob or button, carrying the lever shown.

The counting-wheels of the meter are attached to, and driven by, the ordinary moving parts in the usual manner. They are connected

with the index-wheel by any train of wheels, by which the rate of rotation of the shaft A, and consequently the table B, is made to correspond with the passage of one unit quantity of gas—say, for example, 25 cubic feet (*i.e.*, at the rate of 3s. 4d. per 1000 feet), or such other quantity as is to be supplied for 1d. When a penny is inserted in the slot, and supposing the meter to be at rest and the gas "off," the coin G falls on the arm T^1, as shown in fig. 2, but does not by its weight depress or operate the arm. If now the knob H is turned in the direction indicated by an arrow on the face of the meter—*i.e.*, from right to left—the arm comes in contact with the coin and presses it downwards, thereby depressing the coin and the arm T^1 until they assume the position shown in fig. 3, beyond which the lever cannot reach the coin. In this position, the coin is held between the arm T^1 and the side of the coin-shoot until it is released. The depression of the lever T^1 will have slightly rotated the shaft E, and carried the lever P away from the disc B, and also have carried the arm O out of the path of the arm S. The meter being thus set free to rotate, will, under the influence of the pressure of the gas, come into action; gas will commence to flow; and the disc B will rotate, and force back the lever P still farther, thereby further rotating the shaft E, and carrying the arm T^1 backwards, far enough to allow the coin to pass, as shown in fig. 4, in which the position is represented at the moment of the release of the coin from the arm T^1. Thereupon the coin drops into the coin receptacle below; and as the disc continues to rotate, the pin passes down the opposite incline of the cam, and, if there is no other penny following, it rests on the surface of the disc until the part of it immediately in advance of the opening passes in front of the pin P, so that, as this part of the disc passes, the pin is allowed to advance slowly a distance equal to about two-thirds of the thickness of the disc, thereby advancing the stop O to a corresponding extent. This advance of the stop is just sufficient to allow the arm S to rub against the stop O, and push it back far enough to enable the arm to pass. But in doing this, the motion of the arm is retarded so much that the flow of gas is lessened. The flames at the burners thus sink slightly on the first occasion, but more with each succeeding revolution of the arm, until the stop passes so far forward that the arm S on its next revolution strikes the side of the stop fully, and cuts off the supply of gas.

In order to prevent the supply of gas being absolutely stopped after each pennyworth is consumed, means are provided by which several pennies may be inserted at once, or before the gas purchased by the first penny has all been used, and a constant flow of gas thereby maintained. To this end, the arm T^2 is provided, and is so arranged that when a coin rests on the arm T^1, as in fig. 2, or is engaged between it and the shoot, as in fig. 3, another coin descending the shoot rests on the first one, and is thus supported, together with any others which may be passed in on to it. As soon, however, as the cam begins to force back the arm P, the arm T^2 is thereby made to advance from the position shown in fig. 3 to that shown in fig. 4, thereby engaging the second coin G^1, and preventing its descent when the first coin G descends to the coin receptacle.

Water-Meters.—Curle, W., of Newington Butts, S.E. No. 11,289; June 8, 1893.

This invention, it is claimed, provides "a meter which will work with any or a varying pressure, shall have all its bearings and the like out of water, will register accurately, and be efficiently safe-guarded against the lifting of the supply-valve."

The meter is separated, by a horizontal diaphragm, into two chambers. The upper of which is the measuring chamber. The water is delivered into this measuring chamber, near the diaphragm, through a pipe controlled by the supply-valve—preferably of such a construction that the motion of the spindle through an arc will open it, and a reverse motion close it. The rush of water into the measuring vessel is checked down to a steady delivery by a ball or float, the rise of which engages a lever connected with the valve, so as to close the latter as much as may be necessary. Two floats or balls are made fast by their stems to the spindle, at about right angles with it—one on each side of the vertical plane passing through the axis of the spindle. The rising water lifts (say) the front float, and pulls the back one to the front of the vertical plane, whereupon its lift closes the valve. This is timed by the position of the two floats to be effected when the given quantity of water has entered the measuring chamber.

An arm, preferably from the stem of the first-mentioned float, engages with the registering device; while a second arm, preferably from the same float, is adapted to lift a third arm pivoted to the side of the measuring vessel. From this third arm depends the spindle of the valve on the diaphragm, through which the water flows into the second chamber. The lead of this valve consists of skeleton wires arranged triangularly in plan, instead of the usual three wings heretofore used, so as to expedite the flow of the water. The latter falls into an open bowl or receiver, supported at a suitable height in the second chamber, and flows from the receiver over its sides, as well as through a port of a definite size formed in or near the bottom of it. The receiver contains a float, the spindle of which is led upwards, through the diaphragm and a pipe standing up therefrom, to the outer end of the third arm, to which it is connected. The point at which the diaphragm-valve is connected to this arm is between its outer end and its pivot.

As the third arm drops, following the water escaping from the measuring vessel into the second chamber, the diaphragm-valve settles on to its seat by the time the vessel is empty; the empty receiver being checked by the size of the port in the bottom of it.

A counterpoise equal to the pressure in the main is provided, for the purpose of closing the supply-valve. It is hung on a lever connected with the latter; and the counterpoise is itself counterpoised by the power of the float in the receiver, through a suitable connection. This latter float is strong enough to keep the supply-valve closed against the pressure in the main, even if the first-mentioned counterpoise is out of action. If both fail, then the second float is capable of keeping the valve on its seat.

Condensers.—Cutler, S., of Millwall. No. 11,734; June 14, 1893.

This invention relates to tubular gas-condensers "where water or other liquid is employed as the cooling medium;" and it has for its object "to provide means for permitting free expansion and contraction of the condensing-tubes under the influence of varying temperature, thereby dispensing with the use of expansion-boxes, also to induce the ready separation of suspended tar and aqueous vapours from the gas, by increasing the condensing surface."

Fig 1.

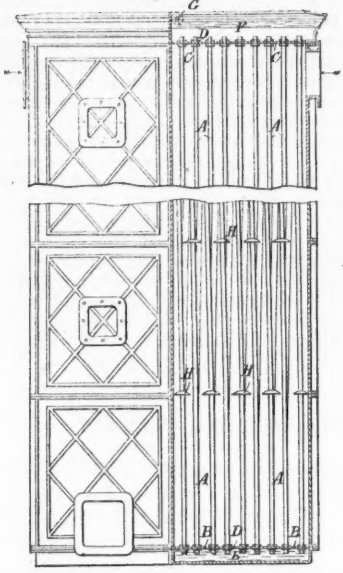


Fig. 2.

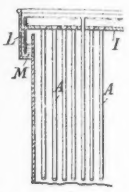


Fig. 1 represents, partly in elevation and partly in vertical section one form of such a condenser; and fig. 2 shows a vertical section of a part of a modified arrangement.

In fig. 1, the tubes A, instead of being straight and provided with expansion-boxes in the ordinary manner, are of a "curved sinuous, helical, or spherical form," with their ends rigidly jointed to the tube-plates B C by nuts D. The liquid employed as the cooling medium enters the tubes at their lower extremities, from a common chamber E; and, flowing upwards, is discharged into a receiver F, surmounting the upper tube-plate C, and whose outlet G is at such a level above the tops of the tubes that an equal pressure is maintained in all the tubes. To increase the condensing surface, and induce the ready separation of suspended tar and aqueous vapours from the gas, there are placed upon the tubes a number of radiating-plates H, either horizontal, as shown, or in inclined positions.

In the modified arrangement shown in fig. 2, the tubes A are also rigidly jointed to the tube-plates, the upper one I of which has a flange L, which is immersed in a lute M containing liquid, to prevent the escape of gas from the interior.

APPLICATIONS FOR LETTERS PATENT.

9480.—Cowan, W. and W. H., "Prepayment gas-meters." May 15.
9505.—Newman, J. J. and P. F., "Gas-burners." May 15.
9517.—Tibbitts, M., "Draught creator and gas-lamp combined for ventilating sewer shafts." May 15.
9607.—Warren, G., "Spraying apparatus for liquid fuel." May 16.
9690.—Jahnsson, J., "Electrical device for facilitating the lighting of gas." May 17.
9692.—Chamberlain, W. T., "Steam, air, gas, and vapour generators and motors." May 17.
9763.—Cadot, P., and Charron, A., "Horary meter for electric light, air, gas, water (compressed or not), and motive force." May 19.
9783.—Ewing, W., "Generator gas-furnaces for carbonizing coal." May 19.
9813.—Allen, P. R., "Meters or apparatus for supplying electricity, gas, or other substances, in exchange for coin." May 19.

Oldham Corporation New Water-Works.—Mr. G. H. Hill recently forwarded to the Oldham Corporation Water Committee a report upon the cost of the Castleshaw extensions, and as to the general expenditure upon works authorized by the Act of 1886. The works are now completed; and it is interesting to make a comparison of the actual cost of the works with the parliamentary estimate. The Act provided the sum of £360,000 for the following works: Castleshaw extensions, £210,727; Ogden reservoir, £14,697; Rooden reservoir and watercourse, £89,256—total £314,680. This left a sum of £45,320 for contingencies, engineering, the Act, and legal and other expenses. In addition to the £360,000, the sum of £50,000 was provided for extensions of mains and pipes in the district of supply. The parliamentary estimate for the Castleshaw extensions amounted to a sum of £210,727; and the actual cost of the works, including a charge against the work done of £15,245 for the use of plant, amounts to £209,817—being £910 less than the parliamentary estimate. By the successful negotiations of the Town Clerk and Committee, the land was obtained for considerably less than the sum provided in the estimate; but, on the other hand, several works have been included that were not contemplated at the time the Bill was deposited—viz., the entrance road to the works, meter-house, and 6-inch pipe to Delph. The work at Ogden is not yet finished. But the amount set down in the parliamentary estimate, including land, was £14,697; while the actual cost to the end of 1893 has been £19,322. This amount, however, includes the purchase of land and buildings not contemplated when the estimate was made (amounting to about £4000); and the cost will be reduced by the value of the plant remaining at the completion of the works.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

The Profit-Sharing System.

SIR,—On the previous occasion when I read a paper on "Profit-Sharing," you took a broad and enlightened view of the question; while, in the discussion of the paper, most of the speeches went off on side issues. This year, however, those conditions are to a great extent reversed. The discussion was generally to the point; whereas in your remarks on p. 888 of the JOURNAL, it appears to have been missed or misunderstood. Most likely some word or remark of mine conveyed a different meaning to that which was intended. If so, I hope, with your permission, to be able to set it right, for the subject is of too much importance to be left in uncertainty.

You say that "it cannot be argued that what" I call "profit-sharing is soundly based upon a principle susceptible of general application." To this I reply that if it is not "soundly based"—and on that point I can pit, as an argument, five years' successful working against your theory—it must fail (of which it shows no sign), and will do nothing but harm; whereas, so far, it has done nothing but good. Further, I argue that the profit-sharing arrangements that have been adopted by the South Metropolitan and Crystal Palace District Gas Companies are not "colourable imitations of the real thing, founded upon a wholly artificial basis," as you say, but the "real thing" itself—that is, the genuine principle of profit-sharing adapted to the special circumstances of sliding-scale gas companies. Profit-sharing is a principle capable of very general, though probably not of universal, application in industrial business. It is, moreover, a principle capable of great variation in its adaptation to the various phases of industrial life. I never said, or intended anyone to infer, that the special adaptation of the principle of profit-sharing that has been adopted by these Companies is susceptible of general application to businesses of an ordinary kind; but I do say that it is the "real thing" adapted to exceptional circumstances.

What is profit-sharing? I can best answer this question by the following statement: The same doubt as to our system being the "real thing" occurred one day, at the Labour Commission, to Mr. Mundella, who asked me for information on the subject. This being given, he then said: "Does the bonus paid to your workpeople rise and fall with the dividend paid to the shareholders?" The reply was, "Certainly;" to which came the further reply, "Then I am satisfied it is genuine profit-sharing." I quote from memory, and believe these were very nearly the words used; but I am certain the full and true sense is given.

I can, however, make excuses for you, for I confess that at one time I questioned myself whether the system we had adopted was really profit-sharing. But I am now convinced that this adaptation of the principle is more nearly perfect than is to be found in those cases which are supposed to be the "real thing," where profit-sharing is applied to an ordinary business, because profits are shared by all the interested parties—viz., the capitalists, the workers, and the consumers or customers. Anything that tends to improve and cheapen the supply of gas, benefits all three. The sliding-scale brought shareholders and consumers into partnership, which is only another name for profit-sharing. The third partner in the business is, by our system, brought in also; and he has surely as good a right, and as strong a claim, to benefit by improvements and by any unearned increments—to gain when coals are cheap, and to lose when they are dear—as either shareholders or consumers, besides meeting with the special reward of his own exertions and intelligent interest.

You say further that in both cases "the Directors have assumed quite arbitrarily a starting-point from which an advance upon. . . wages rates may be calculated." I will not waste time over the latter part of this quotation; but I may ask what ground there is for assuming that we "have assumed quite arbitrarily a starting-point?" Surely we are as well able to fix a starting-point tentatively and approximately fair in this matter as any man or body of men can fix starting-points in the innumerable affairs of life. The initial price in Gas Companies' Acts of Parliament is a starting point; and how is it fixed? Further, our starting-point has been fixed, after very careful consideration, as fairly as it could be done. If at any time it is found not to be fair, it can be altered *either way;* for such is my conviction of the desire of the employed to be reasonable, that I should not hesitate, if I felt they were getting more than their share of profits, to tell them that the starting-point must be altered against them. I have no fear that they would not accept such a proposal, properly explained, in a friendly spirit; for one of the great incidental advantages of the system is that it promotes mutual confidence.

If the remark that this form of profit-sharing "means turning the existing maximum rates of wages into minimum rates," then there is no such thing as profit-sharing—there is no "real thing;" for such a remark would apply to all its adaptations. Profit-sharing is not an increase of wages, but something outside and beyond wages. It is no more (if so much) an increase of wages than the commission paid to an official beyond his salary on the business he does for his firm is an increase of salary. The effect, moreover, is totally different from an increase of salary or wages. Profit-sharing is rather making the employed a partner with his employer, which no mere wages payment, minimum or maximum, can by any possibility effect; and it is to partnership, in one form or another, that we must look for industrial prosperity and peace.

Reigate, May 25, 1894. GEORGE LIVESEY.

[Allusion to this letter will be found in our leading columns to-day.—ED. J. G. L.]

Gas Monopolists and the Hiring System.

SIR,—A rather extensive correspondence on this subject has been going the round of the press, and many unfounded assertions have been made by persons who evidently have a very incomplete and incorrect knowledge of the trade as it actually exists.

With special reference to a letter which has recently appeared, we have no hesitation whatever in denying, in the plainest possible language, the statement that "the trade in gas appliances by ironmongers, &c., in this country has practically disappeared under the influence of this great monopoly by gas companies and corporations." On the contrary, the trade in gas heating and cooking appliances done by ironmongers and gas-fitters is, and has been for many years, a steadily increasing one. The fact that the transactions with gas companies are increasing in amount, as are the transactions with ironmongers and gas-fitters, simply proves the great increase in the general use of gas for heating purposes which has been caused by the hiring-out and exhibition system fostered by the gas companies to increase the sale of day-gas. Of the numerous patterns made by ourselves, at least four out of five are made for the general trade, and are not touched by the hiring companies. If the state of the trade were as it is supposed to be by the writers, we should be exceedingly foolish to print, year after year, large illustrated lists of patterns made for sale by ironmongers and gas-fitters.

The gas companies let out apparatus on hire for the sole purpose of increasing the sale of gas; and therefore they naturally select strong and simple appliances, of pattterns which give the least trouble to themselves; and this, of course, means also that they adopt as few patterns as possible. Of those persons who now hire gas heating and cooking appliances, we think we are well within the mark in stating that not one in a dozen would purchase if they could not hire; and those who do hire are much more likely to purchase other appliances than they would be if they had no experience of gas as a fuel. Our own experience as manufacturers goes to prove that a very large increase in the demand comes from gas-fitters, and that it is caused by the liberal action of the gas companies in endeavouring to popularize the use of gas for other purposes than lighting.

Warrington, May 26, 1894. THOS. FLETCHER.

The Meter System v. Inspection for Detecting Waste of Water.

SIR,—In the JOURNAL for March 20 (p. 536), there was an abstract of a paper on "The Prevention and Detection of Waste of Water," read by Mr. E. Collins before the Institution of Civil Engineers. In the course of his paper, the author stated that undue consumption was hard to define; and he instanced the automatic flushing-tank as being objectionable. This is perfectly correct; and at the same time it is not the most efficient sanitary appliance that can be adopted. But no water company outside of London would allow such a wasteful apparatus to be fixed, unless it was supplied by a meter having a minimum rate. He also stated that "hydraulic motors, lifts, and elevators, when worked off comparatively low pressure mains," occasion undue consumption. But they should not be considered a cause of waste; for, of course, the more water they use, the more they will have to pay for. I know of no company supplying water to work such machines for trade purposes at a fixed rate. Sometimes these motors may be working day and night, nearly the whole year through; and therefore rating would be impossible in such cases. Surely lifts and elevators are supplied by meter in London, as they are elsewhere. Fountains would be served by meter also; and the garden supply by hose is usually charged as an extra. Of course, the hose may be left running all night. But the night inspectors will report all such wilful waste; and there is a fine for wilfully wasting water. This fine should be enforced a few times; and then all waste arising from this cause would soon cease. The water companies have the remedy in their own hands. The Secretary of the Kent Water Company once issued notices stating that, in future, measures would be taken to recover penalties in these cases; and this action on his part had the desired effect.

The regulations for the use of proper water-fittings and the control of plumbers date as far back as 1858; and in Manchester the testing and stamping of fittings has been very successfully carried on in a most businesslike manner, ensuring excellent workmanship. Had a tithe of those regulations been adopted and put in operation in London, and stopcocks fixed on the services, the waste-water meter would never have been heard of. They are now being slowly introduced into London; but, before much good can be expected, they must be carried out in their entirety and thoroughly at every water-works, however small. Light, soft metal fittings untested must lead to much trouble, constant waste, and the Law Courts.

The system of detecting waste was first inaugurated in Liverpool by Mr. John Hays Wilson, a member of the Town Council; but it was left in abeyance for some time, as was also the system of inspection for waste, until the waste grew so enormous (as is the case at present in London) that some check had to be found. It is a difficult matter to control people who have been allowed to waste water for a number of years with impunity. But Liverpool, like many other towns, having neglected to inspect and check waste, had to pay the penalty, and introduce a most drastic and expensive measure. The idea of parcelling out the town into meter districts was started by Mr. T. Duncan, the patentee of Duncan's water-meter; and night inspections are due to Mr. J. Parry, a water-works engineer, and the author of "Water Supply." I have been unable to discover in the JOURNAL the name of William Peace in connection with any method for the prevention of waste or the detection of leaks. I find no attempt being made, except by Mr. J. H. Wilson and the Kennedy Meter Company. Some of your readers might possibly be glad to have Mr. Peace's method described in your columns.*

The author went on to say that "a waste-water meter would enable an inspector to see at a glance the precise locality in any district where waste was taking place." I have had some experience with the system; and I really cannot see how the waste is ascertained. The diagram taken simply shows what amount of water is passing, and the time the greater quantity was passed; but it does not tell me at what house—whether No. 10 or No. 410, and I have to visit or stethoscope every service-pipe or stopcock, precisely as is now done in all well-regulated water-works. Of what use, then, is the diagram, seeing that

* The various systems of preventing waste of water were reviewed in the JOURNAL March 20, 1888 (p. 509), Oct. 9, 1888 (p. 632), and July 23, 1889 (p. 164).

I can tell, by shutting down the sluice-cock, within 1-16th of a round, which commands the district, if there is any waste going on? There always is waste going on, for if everything is quite tight to-day, something will very soon break up; so I must be constantly going the round, as recommended by Mr. Collins, sounding all service-pipes, stopcocks, hydrants, and main-cocks. If a system of meter diagrams is kept at the office, that does not prevent a continuous series of leaks occurring; and after twenty years' inspection, I must say I find a disciplined constant round of sounding *by night* by far the most efficient, and considerably the cheapest system. Why is it that Manchester can check all waste, keep up a constant supply at about 20 gallons per head, and not resort to the method of waste meters? Their system of testing fittings and constant and systematic inspection of all plumbing, mains, and fittings, is carried out with discipline, and, being constant, no leaks can elude the vigilance of the night man.

The fact that many of the works in which the meter system has been tried have discontinued its use, as stated by the author, is very significant. In 1876, the late Mr. Hawksley reduced the consumption at Norwich from 40 to 15 gallons per head per day without adopting that system; thus showing that it is not necessary. The same thing was effected in Glasgow by Mr. Steward; and it is being done in numbers of towns at the present time. Mr. Collins is of opinion that the system is indispensable for a constant supply. This cannot be the case when about 400 towns, giving a constant supply, are showing better results per head per day at a much less annual cost. He also states that it is necessary that these meters should be "constantly worked," which means the diagrams should be taken from every meter daily by experienced mechanics, and the records worked out at the office by efficient clerks. In fact, all the staff are more highly-paid men than are required by the night-inspection system of sounding all services; and, in my experience, a larger number are required. As to finding hidden leaks after the night inspector has sounded all the services, water-closets, and hydrants, it is contrary to my experience. I have measured several districts after the night man has stethoscoped; but in no instance could I discover a leak he had overlooked. If the night is still, I do not see how he could miss a leak with a good sensitive stethoscope. Of course, in the author's case, the waste was found to be excessive; for, in my experience of London water distribution, there has never been any pretension to check waste, except by sending a few men from house to house to inquire how the fittings worked. Waste cannot be stopped by day inspection. It is not making a fair comparison to institute an elaborate and costly system, with many refinements, and conducted by highly-paid officials, and then pit the results against no system at all, with not even an attempt to remedy the defects.

Engineers are tempted to purchase waste-water meters for trial; and these are duly fixed and experimented upon, when it is well known that there are hundreds of closets running all night, and taps over sinks left open for the purpose of cleansing the drains, and numerous other defects within the knowledge of street men. Mr. Collins says that one-third of the waste has been traced to these sources; whereas, if the stopcocks were fixed first, all repairs done, and the district properly inspected, there would be no waste to record. All this is recommended to be done by the meter advocates and vendors; and it must be done, before the meter system can be carried out in its entirety. Then why not start fixing the stopcocks first, and find all defects that must be remedied exactly the same as after the meters are fixed? In Liverpool there are four gangs of inspectors, each consisting of one chief inspector and two assistants; but, as there are upwards of 200 districts in Liverpool, they are said not to be nearly sufficient to carry on the work. There are also four gangs by day, as well as gangs of pipe-layers. There are clerks to send out notices and keep the "waste-books," and two re-examiners to ascertain if the work has been properly done. Besides all this, in the testing-house for fittings there is one superintendent, four assistants, and two labourers, and the population is about 700,000. Are there no lifts, motors, or engines working in Shoreditch by night? If so, the ordinary meters which serve these appliances must be read every night, and placed on the record of the diagrams.

It is very difficult to obtain correct figures as to the cost of working the meter system. The author of the paper states that usually, in London, the initial cost is about £150 for 1000 houses, and that in Shoreditch, with an estimated population of 87,000, it costs £1800. I take it that this represents about 15,000 houses; and assuming the first figures to be correct, it would amount to £2250, and not £1800. An estimate for laying down Deacon meters in Manchester in 1887 was stated to be £41,732; and the annual cost would amount to £3626. In one instance, I find an estimate for a town having a population of 30,000 requiring 14 meters. The first outlay was reckoned to be £800; and the annual cost, £400. This was to have effected a saving of 5 gallons per head per day; and I find this saving was eventually obtained by a system of night inspection, at a cost of £200 per annum. If the author would kindly furnish the figures in detail for the introduction of the system to a town of (say) 50,000 inhabitants, and give the proper expense incidental to keeping the system in an efficient state, it would be a great benefit to many readers of the JOURNAL, who would doubtless, in return, supply figures for a cheaper and more efficient plan.

May 12, 1894. WASTE INSPECTOR.

The Chesterfield Corporation and the Water-Works.—The Chesterfield Corporation privately considered at a recent meeting a resolution bearing upon the question of purchasing the water-works. Before going into Committee, however, Alderman Clayton, who had given notice of the resolution, stated that he thought it only fair to the ratepayers to say the Corporation had a perfectly free hand so far as the purchase of the gas as well the water works was concerned; and it would be for them to decide whether it was advisable to buy both. His motion would not pledge the Corporation to do so. It was in favour of a Committee being appointed to inquire into the questions involved in the proposed acquisition, either alone or conjointly with the Local Boards of the adjoining district, with power to call in experts, and to subsequently report to the Council on the matter.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following progress has been made with Bills:—

Bills read a second time and committed: Electric Lighting Provisional Orders (No. 2) Bill, Wakefield Corporation Bill.

Bill reported: Electric Lighting Provisional Orders (No. 1) Bill.

Bills read the third time and passed: Bury Corporation Bill, Neath Corporation Water Bill, Torquay Gas Bill.

Petitions against the following Bills have been presented:—

Falkirk Corporation Gas Bill, from the Falkirk Joint-Stock Gas Company (against alterations).

Newcastle and Gateshead Water Bill, from the Duke of Northumberland, Corporation of Newcastle-upon-Tyne, and others.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, May 9.

(*Before Mr. Justice* NORTH.)

The Mayor and Corporation of Bradford v. Pickles.—Interference with a Source of Water Supply by Quarrying.

This was an action brought by the Corporation of Bradford to restrain the defendant, the owner of land adjoining a place called Manywells—the source of some of the water supply of the Corporation—from doing certain work, under the guise of preparing to raise stone, so as to divert the water before it reached the channels through which it flowed into the Hewenden reservoir. The case was heard on motion, treated as the trial of the action, in July last. It occupied many days, and involved important questions on the construction of Local Acts of Parliament and on the general law relating to rights in underground water. The springs and some of the land on which the plaintiffs' water-works are situated were acquired by their predecessors in title—the Bradford Water Company, which was incorporated by Act of Parliament in the year 1842. In 1854, a new Water Company was incorporated, who took over, under their Act, the water-works at Manywells; and in the same year another Act was passed, under which the Corporation acquired those works. By section 233 of the Act of 1842, the first Company were authorized to divert and take the water from the springs at Manywells. Section 234 contained provisions prohibiting any person other than the Company from doing acts in terms which were substantially reinacted by section 42 of the Act of 1854 as follows: "It shall not be lawful for any person other than the Company to divert, alter, or appropriate, in any other manner than by law they may be legally entitled, any of the waters supplying or flowing from certain streams and springs called Manywells, arising or flowing in and through a certain farm called Trooper or Manywells Farm, in the township of Wilsden, in the parish of Bradford, or to sink any well or pit, or do any act, matter, or thing whereby the waters of the springs might be drawn off or diminished in quantity; and if any person shall illegally divert, alter, or appropriate the waters or any part thereof, or sink any such well or pit, or do any such act, matter, or thing whereby the waters may be drawn off or diminished in quantity, and shall not immediately, on being required so to do by the Company, repair the injury done by him, so as to restore the springs and the waters thereof to the state in which they were before such illegal act as aforesaid, he shall forfeit to the Company any sum not exceeding £5 for every day during which the supply of water shall be diverted or diminished by reason of any work done or act performed by, or by the authority of such person, in addition to the damage which the Company may sustain by reason of their supply of water being diminished." The defendant's farm was on higher ground than Manywells. It seems that water is held in the sandstone formation under the defendant's land between two more or less impervious faults. The defendant had begun to construct certain shafts, and intended to tunnel through the faults for the purpose of draining the water from his stone, with the alleged object of raising flag and other valuable stone. The effect of his so doing would be to deprive the plaintiffs of their water. They desired to restrain him from so doing. The plaintiffs contended that the defendant was prohibited by Act of Parliament from diverting the water in the manner proposed, both by the provisions of the Special Act and also by general provisions contained in the Water-Works Clauses Act, 1847. They further maintained that the defendant was not acting *bonâ fide;* that he could not profitably raise stone, if there were valuable stone on his land, in the way proposed; and that his object was to extract payment from the plaintiffs to buy him off. On the part of the defendant, it was contended that there was no enactment to take away his ordinary legal right to divert the underground water; that he was acting *bonâ fide;* but that, even if he were not, he had, as owner, the right to divert the water while it was flowing in undefined channels.

Mr. COZENS-HARDY, Q.C., Mr. B. EYRE, and Mr. C. M. ATKINSON appeared for the plaintiffs; Mr. EVERITT, Q.C., Mr. TINDAL ATKINSON, Q.C., and Mr. BUTCHER represented the defendant.

Justice NORTH to-day delivered an elaborate judgment, in the course of which he said: In my opinion, what the defendant is proposing to do is forbidden by section 234 of the Act of 1842 and by section 49 of the Act of 1854, which now takes the place of the former section. He is doing an act or thing by which the water of the springs will be drawn off or diminished in quantity, and not merely diminished, but wholly abstracted. It is said that the defendant is only forbidden by that section from diverting, altering, or appropriating the water in question by or in any other manner than he is legally entitled to do; and that, as he is legally entitled to drain his own land in order to get his stone, diversion for that purpose is not forbidden. But that argument ignores and deprives of meaning the subsequent part of

the section, which goes on to make something more unlawful than is already forbidden—viz., sinking any well or pit or doing any act or thing whereby the waters of the springs may be drawn off or diminished in quantity. If the words "in any other manner than they are by law legally entitled" are read as modifying all that follows, it makes the section enact that a man is not to do certain specified things, except so far as he may lawfully do them, which is making nonsense of it. I do not think the section is very happily expressed; and, in my opinion, the opening provision is intended to preserve against the Water Company such rights over the waters in question as an upper riparian proprietor has against a lower riparian proprietor in an open stream; permitting a diversion or alteration, or even an appropriation to a limited extent, but not a diversion or appropriation by way of a diversion of the whole. Some reference was made to the provisions of the Water-Works Clauses Act. But I think the provisions of section 49 of the Act of 1854 much stronger than anything to be found in that Act. It was argued for the defendant that section 49 is only intended to apply to acts done by the Water Company or persons claiming under them, or, at any rate, to acts done upon their land. But I see no ground for this. It would be absurd to say that the section is merely aimed at preventing the plaintiffs from doing acts to their own prejudice, or forbidding such acts being done by trespassers on their land. Its object must be to prevent such acts being done to the injury of the plaintiffs by any other persons. It was also argued by the defendant's Counsel that it could not be the meaning of the Legislature that he should be restrained from utilizing his stone in the way in which he could otherwise have lawfully done, when no provision is made for compensating him for the loss thus cast upon him, as this would amount to gross injustice. This is a very weighty argument. At the same time that result must follow if the Act says so, as I think it does in the present case. But I am not satisfied that this does produce any injustice to the defendant, as I do not see how this construction of the Act passed in 1842 deprives him of anything which was of the slightest value. What appreciable value could possibly have been attributed to the stone which the defendant says he is now prevented from working by such a construction of the section? Nay, more, there is no evidence before me that at the present moment any person would pay anything for the right to get whatever stone may be found in defendant's land below the level of the Manywells Springs. After shortly referring to the facts in evidence on this point, his Lordship said: I come to the conclusion that, if I had now to say what compensation should be awarded to the defendant in consequence of his not being allowed to make the tunnel, I should be unable to say there was any damage entitling him to compensation. But a second ground for relief was put forward by the plaintiffs, which gave rise to serious discussion. It was said that, assuming that the defendant could not be restrained from making the tunnel, if it were *bonâ fide* done for the legitimate purpose of getting the stone under his land, notwithstanding that the result would be to drain the Manywells Springs, still he ought to be restrained, because his object is not to get his own minerals, but to injure the plaintiffs by carrying off the water, and compelling them to buy him off in order to avert this. This argument was strenuously urged before me; and, as the case may go farther, I feel bound to put on record my view of the facts. I have come to the conclusion that this charge against the defendant is well founded, and that his operations are intended for the drainage of his stone, not in order that he may be enabled to work it, but in order that the plaintiffs may be driven to pay him not to work it. His Lordship considered the bearing of the facts that led him to this conclusion, and continued: It remains to consider whether, the facts being as I have stated, the defendant can be restrained from making the tunnel proposed, on the ground that he is not acting *bonâ fide*. No case in their favour, directly or nearly in point, was cited to me by the plaintiffs' Counsel; and I have not been able, after much research, to find one for myself. Under the circumstances, I come to the conclusion that the plaintiffs are not entitled to relief on the second ground. After dealing with some other points raised in the case, his Lordship said: I must therefore grant an injunction to restrain the defendant, his servants, workmen, and agents, from making and continuing the drift or tunnel in the pleading mentioned, and from constructing any other works, and from doing any other act, matter, or thing whereby the waters of the Manywells Springs, or of the stream flowing at the watering-places, may be drawn off or materially diminished in quantity or be polluted. I add the word "materially," though it is not found in the Act, because I think the Act does recognize the possibility of some legal appropriation by the defendant of water supplying the springs. Moreover, the principle of *de minimis non curat lex* applies. The question of costs is a very serious matter. Of course, the plaintiffs are entitled to the general costs of the action. But a very considerable amount of time and money has been expended upon the question of the *bona fides* of the defendant, with respect to which the plaintiffs have failed; but the defendant has not been successful. It would be impossible for any taxing master to distinguish or appropriate the costs with any approach to accuracy; and I think, having heard the case, I can deal with them much better myself. I therefore take it upon myself to direct that the plaintiffs' costs shall be taxed, and to order the defendant to pay half the plaintiffs' costs.

Shoreham Water-Works Company.—In their half-yearly report, the Directors of this Company, referring to the Steyning Water Company's Order, stated that they had given the promoters every facility for obtaining the proposed powers, feeling that the undertaking would be not only for the benefit of Steyning, but also to the advantage of the intervening parishes of Bramber and Beeding. The Order had, however, been refused, on account of the Rural Sanitary Authority having withdrawn the consent they had previously given. In connection with their own works, the Directors informed the shareholders that they had decided to increase the pumping power by erecting a third engine and pumps, capable of raising 60,000 gallons per hour, and another boiler, with the necessary buildings and coal-store. It was estimated that the cost of these additions would be about £3000. At the recent meeting, a dividend at the rate of 5 per cent. per annum was declared upon both classes of shares; and the Directors were empowered to issue further capital to the extent of £4000.

MISCELLANEOUS NEWS.

BIRMINGHAM CORPORATION GAS SUPPLY.

The Annual Report and Accounts.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Alderman Johnson) presiding—the report and accounts of the Gas Department were submitted.

Alderman POLLACK first moved a resolution authorizing the appropriation of £24,551—being the net profit of the Gas Department for the year ended March 31 last—to the credit of the improvement rate of 1893. He pointed out that there were three important factors in the accounts of the department during the year—the coal strike, the decrease in the consumption of gas, and the increase in price. In December last, he estimated the additional purchases of coal rendered necessary by the strike at £24,000. This had been reduced to £15,000—an economy of £8000 having been effected by reselling the coal practically at the pit as soon as the ordinary contractors had resumed delivery. The estimated saving of coal referred to in the last annual report had also been carried out; otherwise the unfavourable trading of 1892-3 would in itself have necessitated an increase in the price of gas. The advantage thus gained, however, had been entirely lost through the strike. In 1888 they paid £162,000 for coal, with an output of 3500 million cubic feet of gas; while in 1893-4 coal cost them £261,000, or 62 per cent. more, with an output of 4000 million feet of gas, or only 14 per cent. more. But while the price of coal had gone up until it was even now 50 per cent. higher than in 1888, during the whole of the time the Committee had not altered the price of gas. At last they were obliged to increase it; but the revenue from gas for the year just ended only showed an advance of £5858, notwithstanding that the increased price came into force during the heaviest quarter of the year. For the first time, in fact, since the acquisition of the gas undertaking, their revenue from gas had been affected by a decrease in the consumption. Discussing this matter in its bearing on the future of the undertaking, Alderman Pollack said that the total decrease in the consumption last year, taking into account the additional consumption which might have been expected from the increase in the number of court and public lamps, was 100 million cubic feet, or 2 per cent. But taking into account that until quite lately there had been an average annual increase of 4 per cent., this really meant a loss to the department of 6 per cent. on the sale of gas. In the previous year, the consumption was stationary; so that the sale two years before actually exceeded by 56 millions that of last year, although they now supplied the whole of Sutton Coldfield. He produced statistics to show that this reduction was not peculiar to Birmingham, and remarked that the reasons given for the decrease were everywhere the same—exceptionally light weather, bad trade, the introduction of the electric light, and the adoption of economical gas appliances. The hours of sunshine registered in Birmingham during the year just passed exceeded by 463 those in the previous year; and in the months in which the increases were shown, there was a considerable falling off in the consumption. March this year showed a reduction in the hours of sunshine as compared with March of last year; and the reduction in the consumption was consequently only two-thirds per cent., as compared with a reduction of 4 per cent. in the December quarter, when the hours of sunshine exhibited an increase. In connection with the question of bad trade, the manufacturing portions of the city showed a decrease in the consumption of from 4 to 7½ per cent. and other parts 3 and 1 per cent. There was an increase of from ½ to 5 per cent. in the outlying wards, attributed to new buildings; while in Edgbaston there was an unaccountable decrease of 7½ per cent., and in Market Hall Ward one of 6¾ per cent.—no doubt mainly due to the use of electricity. Dealing with the effect of the competition of the electric light, Alderman Pollack said that in the year ending March 31, 1891, the department supplied to the Town Hall 23¾ million cubic feet of gas; to the Post Office, 6½ millions; and to other consumers in the present electric-lighting area, 303 millions—making a total of 332½ millions. In the year ended March, 1892, the consumption in that area was: Town Hall, 955,000 cubic feet; Post Office, 3 millions; and other consumers, 339 millions—total, 343 millions. In the year ended March, 1893, it was: Town Hall, 372,600 cubic feet; Post Office, 1¼ millions; and other consumers, 334 millions—total 335¾ millions. In the year just ended it was: Town Hall, 358,800 cubic feet; Post Office, 1,284,100 cubic feet; and other consumers, 310 millions—total, 311¾ millions. Thus, while the total consumption for the area showed in 1891-2 an increase of 3½ per cent., there were decreases in the last two years of 2¼ and 7½ per cent. respectively. It was, therefore, evident to everyone that the competition of the electric light was seriously checking the consumption of gas. As to the fourth reason, it was one which had in the past, and would in the future, still further reduce the consumption. The gas department had always endeavoured to promote the use of gas-saving appliances, believing that a lavish and improvident use of gas was of no advantage to the undertaking. Great strides had been made in the construction of economical gas-burners, especially during the last few years, in connection with incandescent burners. In a recent estimate the Committee had calculated that, by the use of such burners, a saving of 50 per cent. could be effected. The question whether the reduction in the consumption of gas in the city was likely to be permanent, was not easily answered. But it was important, because the Committee were constantly providing enlargements of mains and extensions of plant; and it might be prudent to stay their hands in both respects if they abandoned the hope of a continuous increase in the output. They would be very sanguine if they anticipated the phenomenal weather of the last two years—in fact, there had already been a change this year for April and May favourable to the consumption of gas. Trade, unfortunately, was not mending; but it would be contrary to precedent if the present stagnation proved to be permanent. On the other hand, it appeared likely that the working of overtime would be abandoned to a great extent; and this would necessarily affect the consumption of gas. There was, however, the fact that the improvements in the construction of gas-stoves and gas-

engines had led, and were leading to an increase in their use. But it would be idle to deny that applications of electricity to illumination would grow. Taking all these conflicting elements into account, he had come to the conclusion that they would no longer see their output take the great strides by which it had risen within eighteen years from 2300 millions for a larger area—including Smethwick, West Bromwich, Tipton, and other districts which now supply themselves—to 4000 millions for the present more contracted area, but that there would still be a gradual though slower increase, mainly governed by the state of the weather and trade, and that it behoved them to be prepared for the reasonable maximum output of gas foreshadowed by the extensions in their plant which the Committee had reported from time to time. Except from this drawback of the decreased sale of gas, the accounts had been on the whole satisfactory. The profits from residuals, for instance, had exceeded their most sanguine expectations. They could not, however, have made the contribution to the improvement rate spoken of in the resolution without the higher revenue from gas during the last three months of the financial year due to the increased price. No doubt the Council would be anxious to know how long this increase was to last. All he could say on behalf of the Gas Committee was, "not one day longer than is absolutely needed." For the last three or four years when coal had risen, when expenditure for wages and purification had vastly increased, when almost every gas undertaking in the kingdom had raised its price, the Committee stood by their old charges for gas until it was impossible to do so any longer. Their anxiety to revert to the old prices was no less than it was a year ago. No one was more alive than they were to the advantages of cheap gas in the face of so many competing elements; but it was their duty to present the Council with a clean balance-sheet. The Council would not wish them to follow the example of other gas undertakings in showing a deficit to be carried forward, and to be made good by drawing upon their reserve; and so long as the coal market remained in the present unsettled condition, and they were unable to forecast with any degree of certainty their expenditure for coal or their revenue from coke, they must ask the Council to forbear, and wait with patience, trusting the Committee to take a broad view of the situation, and to act alike in the interest of gas consumers and ratepayers.

Alderman BAKER seconded the motion, which was passed.

Alderman POLLACK then moved the adoption of the report. In doing so, he referred to numerous anonymous letters which have appeared in the press as to increased gas bills, and showed the absurdity of the charges made against the Committee. The most convincing fact, he said, was the reduction in the output of gas. The quanity of gas supplied to consumers showed a decrease of 1·62 per cent. for the quarter ended Midsummer, 1893—4·37 per cent. for Michaelmas, 1893; 4·12 per cent. for Christmas, 1893; and 0·66 per cent. for Lady-day, 1894. But for the fact that there were sixty hours less sunshine during the last quarter than in the corresponding period of 1893, the reduction for the quarter ended March last would no doubt have been greater. Notwithstanding that during the last financial year there had been 3023 new services, the gas supplied to the consumers last quarter was 4½ million cubic feet less than in the same quarter of 1893. He wondered what the people who had made complaints would say at Midsummer, when their gas bills, owing to the increased output of gas due to the cold weather of April and May, would probably show a considerable increase over the corresponding quarter of last year.

Mr. BRADLEY inquired whether information could be given as to the probable time that would elapse before the Committee reverted to their old charges.

Alderman POLLACK replied that the Committee were very anxious to revert to the old price as early as practicable. It was, however, impossible to say anything further until the coal and coke contracts were entered into.

The report was adopted.

WEST BROMWICH GAS UNDERTAKING.

Annual Report and Accounts.

The annual report and statement of accounts in connection with the above undertaking for the year ending March 31 have lately been issued by the Secretary (Mr. T. Hudson). The report states that the borrowing powers of the undertaking have not been increased; but they have been exercised to a further extent in connection with additional plant, both for manufacturing and distributing gas. The loan capital on the 31st of March stood at £183,561. The amount spent during the year upon extensions of plant was £6095. The total expenditure on capital account now stands at £9 7s. 5d. per ton of coal carbonized, or nearly £925 per million cubic feet of gas made; being somewhat high figures as compared with other gas undertakings of the same size. The capital actually employed, after allowing for the amount extinguished or redeemed by sinking fund, was £8 15s. 3d. per ton of coal. The result of the year's working is unsatisfactory, as a deficiency arises for the first time in the history of the undertaking. This is attributed entirely to the strike of colliers; the extra cost of coal during the trouble—some of it having to be purchased in the open market—being about £1150. Against this the Committee purchased coal under new contracts immediately previous to, and since the strike, at prices below those of the previous year. The reduction under this head amounts to £1028; and the difference between this sum and the former, of £1150—viz., £122—shows very little variation from the figures in the previous report when discussing the matter in its relation to the price of gas. But for the reduced price of coal under the new contracts, the price of gas must necessarily have been increased. The report expresses regret that the income from the sales of gas shows a decrease. A large falling off occurs with the consumers supplied at 2s. 3d. per 1000 cubic feet, which embrace the largest works and manufactories in the borough; while those served at 2s. 4d. per 1000 feet show an increase. The decreased consumption was general throughout the entire year. Of the total number of houses in the borough, 4923 only are supplied with gas, leaving 7204 not supplied. The total number of consumers in the borough at the end of the financial year was 5205—a decrease of 35 compared with the previous year. The quantity of gas consumed by them was 183,214,700 cubic feet, or at the rate of 35,200 feet per consumer. The number of meters reported as being in use is 5698, against 5648 in 1892-3, or an increase of 50 in the year. The yield of residual products per ton of coal carbonized shows a diminution when compared with the results of preceding years, which adversely affects the income. The income from gas-fittings also shows a falling off. The total income from all sources was £36,751, compared with £37,114—a decrease of £543. The total expenditure for the year on the trading account was £28,721, against £28,727—a decrease of £6. The total manufacturing charges for the year were £21,577, against £21,288, the excess being equal to 4¾d. per ton of coal. The quantity of coal and cannel carbonized during the year was 20,945 tons—a decrease of 121 tons when compared with the previous year. The total cost of distributing the gas throughout the borough, including repairs and maintenance, was £1616, as compared with £1589—an increase of £27, traceable to greater outlay upon mains and services. The total expenditure in all the departments was £28,721; and the gross profit was £7850, or 4·276 per cent. on the capital employed, as compared with £8386—a decrease of £536. After making proper provision for interest and redemption of debt, the account shows a loss of £265; thereby reducing the cash in hand from £9070 to £8805. The amount standing to the credit of the sinking fund account on the 31st of March last year was £1466. The depreciation fund account has been reduced by £2500 transferred to the credit of the revenue account towards the exceptional expenditure for the year in the retort-house, in the building of retorts on the regenerator system. The amount remaining in the fund is £783. The price of gas is rather lower in West Bromwich than in some of the surrounding towns. At the commencement of the undertaking, for several years in succession the Gas Committee were able to hand over £3000 a year in aid of the rates. During the last few years, the prices of coal have been considerably higher than in the early days of the undertaking, and the price of labour has also advanced. There has likewise been a gradual reduction in the value of the residual products; and these things account for the falling off in the amount of profit in the last few years. Extensive improvements have lately been carried out at the works; and it is anticipated that the current year's trading will be attended with better results.

THE ALLEGED GAS-WORKS "IRREGULARITIES" AT SOUTHPORT.

As will have been gathered from the paragraph which we published last week, very little of importance transpired at the public inquiry which was held by the General Purposes Committee of the Southport Town Council on the previous Thursday into the question of the irregularities in connection with the gas estate; but, seeing that a great deal of unnecessary fuss has been made over what really prove to be small matters, we now give an extended account of the proceedings. It may be mentioned that all who took part in them were members of the Council or Corporation officials.

The MAYOR (Alderman Wood, M.D.), who presided, said it might perhaps conduce to the order of business if he made a short statement as to what had been done by the Auditors and himself in accordance with various resolutions passed by the combined Committee and by the Council. In doing so, he reminded the Committee of the paragraph in the minutes of the Gas and Electricity Committee of April 17, to the effect that the Finance Committee be desired to form with that Committee a Committee for the purpose of investigating the accounts of the gas estate; that all books of account at Crowlands and Eastbank Street be examined by the Borough and Burgess Auditors; and that each member of the Council be informed that he may during the progress of the investigation address any inquiry or suggestion, or convey any information to the Mayor relative to the management of the estate. He might say that he had received no letter or suggestion, so far as he knew, of any kind from any member of the Council. On May 8 the Council, in response to what appeared at the time to be a general wish, enlarged the Committee of Investigation, and made it into a General Purposes Committee. At a meeting of the Council on April 10, an amendment was carried that the balance-sheet rendered by Mr. J. Booth, sen., of money irregularly received and expended by him be referred back to the Gas Committee, with instructions to request the Borough Auditors to compare the statement referred to in the balance-sheet with the books of account, vouchers, and memoranda from which the statement was prepared, and present a full and complete report of the result to the Committee. This had been done; and, put shortly, the report was that they found there were two small balances due to Mr. Booth—viz., £7 4s. 1d. and £1 4s. 7d.—and that, although there had been considerable irregularity, there had been no fraud. Indeed, he might say they could not imagine why Mr. Booth had indulged in a freak of secret bookkeeping, because all the items might have been brought in due order before the Committee, and would, no doubt, have been passed, as there was nothing but what was expended on behalf of the Corporation, and expended, if secretly, yet in a perfectly legal and proper way. The next item he had to refer to was the pencil bookkeeping at Crowlands; and with regard to that there had been great exaggeration. Only subsidiary books for making analyses of wages and retort charges for the purpose of separation and investigation had been kept in pencil; and they found there was only a difference of 2s. 11d. between the cash-book and the cash. The next matter (which was a painful one) was in connection with the Eastbank Street receipts. They went thoroughly into the question of these receipts from March 10, 1891, to March 16, 1894. He regretted to say they found gross irregularities there, although the sums missing could not have amounted to very much. The receipt-books were not paged, the perforation marks were imperfect, and they were badly bound, so that leaves could be abstracted without leaving any mark whatever. Still they found plenty of indications that a large number

of leaves in these books had been cut out. They found there were three ways in which fraud might have taken place in regard to these books. The receipt might have been given, and the copy torn out (in numerous instances the copy had been torn out), or the receipt might have been given on Town Hall paper, or blank paper. In one case the delinquent came before them and confessed he had given a receipt for money on separate paper, and had taken it for his own purposes. In other cases payments might have been made to some small extent and no receipt given at all. If they made every allowance for all these matters, the total amount of fraud could only be very small indeed, and not worth all the trouble and talk made about it. Mr. William Booth, who was the son of their Gas Manager, had been dismissed, and a competent clerk sent in his place, according to a resolution passed by the Gas and Electricity Committee on May 2; and they had decided that a new system of bookkeeping should be arranged at Eastbank Street, and also at Crowlands, so that in future the whole of the bookkeeping at these places might be kept in perfect order, with every receipt accounted for. His Worship next alluded to the appointment of two store-keepers for Crowlands and Eastbank Street; and proceeding he said that, having done all they could to safeguard the property of the ratepayers, they tried to ascertain whether any fraud could have taken place in regard to coal and cannel. In connection with this matter, they took a period of three years; and it would surprise the Committee to hear that they found there was a surplus of 3888 tons, which meant that in three years 3888 tons had been used less than they had supposed. It also meant that, while the books showed a production of 8707 cubic feet of gas per ton, the Auditors' statement proved that more than 9000 feet had been made.

The question of indemnifying any of the employees who might be called upon to give evidence before the Committee was then discussed; and a resolution giving an assurance to that effect was passed.

Mr. J. PLATT, the Corporation Auditor, was first questioned by Mr. Baxter; and he stated that both cash-books at Crowlands were entered in ink. The wages-sheet was also made out in ink, and was signed by the heads of the department, the Borough Treasurer, and two members of the Gas Committee. There was what was called a wages-book; but it was really an analysis or subsidiary book. It was intended for classification purposes, to show what each working department had cost. It was first entered in pencil; and then, after a week or two, it would be posted up in ink. The book had been twelve months in arrear with the posting; but now it was entered up to date. It was, however, of no practical use; it simply enabled them to divide each item. The wages-sheet was written by Kenyon, the chief clerk. The Auditors had never had anything to do with the time and wages books of the employees at Crowlands. They took it that the officials and the members of the Committee who checked them knew more about the men's time than the Auditors could be expected to do. The Auditors saw the wages-sheets when making their regular audit. He had casually seen one of the Gas Manager's reports as to how much it cost for wages, coal, cannel, and so on; and the book called the analysis book would be necessary for the preparation of those reports, but it had nothing whatever to do with bookkeeping. He believed the system of recording the men's time was such as would ordinarily and properly be used in large works. As far as the work done by the clerks at Crowlands was concerned, he thought the Corporation obtained value for their money. He and the Burgess Auditors considered the remarks of the Mayor with reference to the books at the works were borne out in fact.

Mr. ISHERWOOD asserted that he had visited the Crowlands office in company with Alderman Unwin; and they found that everything was exactly as stated by the Auditors. The time-book and everything essential was in ink.

The MAYOR remarked that it might simplify matters if he stated that, so far as their investigations went, there was no charge, or dispute, or doubt, so far as the primary books of the Corporation were concerned. They were all in order; it was in these subsidiary books, through which amounts were gathered in and brought to the Town Hall, that irregularities had existed. But if they gave the utmost latitude for all the frauds that could possibly have been perpetrated, they could not have come to more than £50.

Mr. PILLING said the wages-sheets were brought before the Committee every week, and were carefully examined by a Sub-Committee which met at the Town Hall. One of the most prominent members of that Sub-Committee was Mr. Robson, who never brought before the Committee a single complaint in reference to those sheets.

Mr. THRELFALL observed that, as three expert Auditors had gone into the matter thoroughly, he was bound, in common fairness, to accept the very clear evidence which they brought forward.

The MAYOR explained that the Auditors' statements only referred to the investigation concerning the balance-sheet of Mr. Booth, and did not cover the whole of the ground.

Mr. ROBSON said, as his name had been mentioned, he must point out that, if there was any irregularity in the wages-books, it was impossible for them to find it out. The pay-sheets were verified by people at the head of the departments from whom they were sent; and the gentlemen who examined them could only assume that the sheets and books were correct. But for the fact of a name being inserted in another handwriting, the irregularities might have continued up to that day. Another matter which he wished to touch upon was that of an employee (named Burgess), who, probably through the misinformation of certain members, had been done an injury. He desired that Burgess should be thoroughly righted in the eyes of the Council and of the public. At his (Mr. Robson's) request, Mr. Booth had produced Burgess at a recent meeting of the Committee; and Burgess brought with him his time-book. In reply to the question how it was that Burgess had placed in that book the names of men who had not been working for the Corporation, Mr. Booth stated, in the presence of the whole Committee, that he had instructed Burgess to put those numerous names down on the sheet. [Mr. BOOTH: He is altogether wrong there.] Mr. Booth distinctly asserted that Burgess placed the two men's names upon the sheet by his authority. He asked Mr. Booth whether he considered for a moment the position in which he placed himself as Gas Manager by instructing Burgess to enter those names upon the pay-sheet knowing them to be wrong. Subsequently he (Mr. Robson) saw Burgess, who denied that he had received any such instructions from Mr. Booth, or that he had entered those names upon the time-sheet. But he regretted to inform the Council that, although Burgess had not received such instructions, the orders had been given to someone else. That very afternoon a man named Johnson stated that he had received instructions from Mr. Kenyon to put these names on the pay-sheet; and Kenyon, in turn, asserted that he had received instructions to that effect from Mr. Booth. Continuing, Mr. Robson said that Kenyon had admitted certain instructions from Mr. Booth; and this, he contended, was where the whole of the irregularity had crept in. The Council, he added, were very much indebted to a certain gentleman for giving them a little light in this inquiry. It appeared that certain articles were bought at Eastbank Street and paid for; but instead of this gentleman obtaining a proper receipt, he was given a bill and receipt on a sheet of paper. This thing came before the Committee; and Mr. William Booth, when cross-examined about the matter, said the payment had been made at the Town Hall offices. They had examined the Town Hall books, and found that no such moneys had been paid there. Mr. William Booth then tried to cast the onus of that money upon an innocent employee, who asserted, when brought before the Mayor and others, that he had never received the money from Booth. When the matter was again gone into a fortnight ago, Booth admitted that he had received the money and not handed it over to this person, but had applied it for his own use. He (Mr. Robson) and other members of the Committee had tried to investigate a matter concerning another receipt for 16s. Not only were they unable to trace it, but the duplicate of the receipt was missing from the books; and he believed there were 47 receipts missing. He quite agreed with the Mayor that the amounts would not total to very much; but he was bound to say these matters ought to have come before the Council long ago, and that they would have done had the Chairman of the Gas Committee done his duty. Some time ago, Mr. J. Booth paid £14 which was short; and he ought to have brought the matter before the Committee, and young Booth should have been sent about his business there and then.

Mr. J. BOOTH, the Gas Manager, denied that such a statement or conversation respecting Burgess ever took place at a meeting of the Gas Committee, as alleged by Mr. Robson.

Alderman HACKING said the object of the inquiry was now manifest. It was not to find the "wicked" officials and workmen, but to try to bring disgrace on certain representatives in the Council. What, he asked, had Mr. Baxter done to assist the Chairman of the Gas Committee to administer the gas estate? He had done nothing to help him, but had played the *rôle* of secret inquirer, going round hearing tittle tattle. He (Mr. Hacking) wanted to say there, as he had said before, that he did not for a moment minimize the bad effect of Mr. Booth's irregularities. No one was more sorry for them than he was; and when he thought of it from a parent's point of view, he felt exceedingly sorry that Mr. Booth's son should have embezzled their money. Well out of their turnover of £60,000 last year, they only made bad debts to the amount of £77.

Mr. LLOYD: And the profit was nearly £7000.

The MAYOR wished to say that a man in Mr. Booth's position, with a turnover of over £60,000 per annum, with all the works, men, plant, and other things to look after, really had no right to be burdened with finance at all.

Mr. BOOCOCK said that no doubt mistakes had been made. But it was to him a marvel how Mr. Booth, whom he knew well as a business man, could get through the work connected with so large an estate; and he blamed the Committee for not obtaining the efficient help necessary in all financial matters, so that Mr. Booth might have applied himself with even more zeal and energy to other affairs. In his opinion, if they relieved the Gas Manager from duties which had been over-much for him, and placed efficient officers in the department, so that an error could not creep in again, they might look over this matter, and go on happily in the future.

Mr. HOLLAND was surprised that neither Mr. Booth nor Alderman Hacking had given a direct answer to Mr. Robson's charges; and he contended that Mr. Baxter was fully justified in making the inquiries which he had done. He wished to know whether the Chairman of the Committee had not himself condoned some of the offences, and whether he had taken the Committee into his confidence. Did the Chairman know—and he (Mr. Holland) had reason to believe Alderman Hacking did know—of the irregularities at Eastbank Street, and that Mr. Booth's son, some time ago, was guilty of embezzling money?

Alderman HACKING replied that he was not going to be put on trial by any colleague in the Council. He would again say let the people make their charges and prove them.

Alderman GRIFFITHS said it was a shameful thing for a member of the Council to come there, and hurl charges against an employee of the Corporation, without being able to justify the facts. Mr. Robson had made wholesale charges; and they now came before them, having made an investigation which the Auditors had proved up to the hilt, and which the Mayor, in his statement, had verified with emphasis. They told them the same thing as appeared in the minutes of the Committee on March 30. The Committee said that, while absolving Mr. Booth of dishonest intention, they considered that, in committing the irregularities in question, he had abused the confidence reposed in him. On a previous occasion, one of the members of the Council, when the Mayor stated that the embezzlement only amounted to 46s., said there were thousands behind that. In the interests of the town, he thought it was time such paltry charges were dropped.

Mr. HOUGH, the member referred to, said his remark was that, if the £2 6s. had been embezzled, it was all the same as if it had been thousands. [Two or three members declared that they were confident Mr. Hough's remark was that "there were thousands behind it."]

Mr. W. WOOD was glad that the investigations had been entered upon, as he considered they had now mastered the whole thing. In his opinion, the various Corporation departments would be benefited by it; and he did not anticipate any repetition of the irregularities in the future.

Considerable discussion took place at this stage as to whether some of the employees who had been summoned to attend the

inquiry should be called in and examined; but the Mayor (under the advice of the Town Clerk) ruled that they could not be called, unless some distinct allegation was made.

Alderman FISHEK afterwards made a statement as to the transactions which had taken place at Eastbank Street, where the offices and workshops were situated; and the figures he quoted showed that the average receipts for goods sold were about the same over the past three years. The transactions were really of so small a nature that he did not think the ratepayers need fear that anyone was robbing them of thousands.

Mr. ISHERWOOD moved, and Mr. DIMOND seconded, a resolution to the effect that the proceedings be adjourned until some member had a specific charge to make.

In the course of further discussion, references were made to two or three minor matters. It was also mentioned that the chimney to which allusion was made at the last meeting of the Council was in connection with the Electricity Department, which was under the charge of a separate Engineer.

Mr. Isherwood's motion was agreed to; and the proceedings which had lasted four hours, and had been of a desultory character, then terminated.

Proposed Improvements in the Berwick Water Supply.—Mr. F. H. Tulloch, M.Inst.C.E., held an inquiry last Tuesday relative to an application by the Berwick Town Council to the Local Government Board for power to borrow £3946, which is needed to increase the water supply. During the proceedings, it was stated that the present minimum supply averaged 23 gallons per head; but the Inspector held that 30 gallons was a necessary average to meet the requirements of the town.

Inclined Retorts at the Huddersfield Gas-Works.—Among the minutes presented by the Gas Committee at the last meeting of the Huddersfield County Council was one stating that the Automatic Coal Gas Retort Company, Limited, had consented to the Corporation using their patent inclined retorts in twenty-eight beds, on the Committee paying royalty in three equal instalments—one on the granting of the permit, one on completion of the work, and the last within three months afterwards.

Electric Lighting for Hampstead.—An interesting ceremony took place last Wednesday, in connection with the preparations that have been for some time in progress, under the direction of the Hampstead Vestry, for lighting Hampstead by means of electricity. The cost of the plant, &c., for lighting the whole parish is estimated at £80,000; but at present provision is being made for serving only a comparatively small section of the borough—the compulsory area under the Provisional Order obtained by the Vestry. The cost of the buildings now approaching completion is about £7500; and that of the electrical plant for lighting the compulsory area is £19,794. The central station is in the Finchley Road. The mains have already been laid in the compulsory area; and the lighting is expected to be brought into working operation in a few weeks' time. Mr. Thwaites, the Chairman of the Vestry Electric Lighting Committee, performed the ceremony of placing a memorial stone in position at the new buildings, in the presence of a number of the members of the Vestry and others interested in the undertaking.

Monte Video Gas Company, Limited.—The report which will be submitted to the shareholders of this Company at their annual meeting next Thursday states that the net profit on the working of the year ending Dec. 31 last is £31,161, which has been passed to the credit of profit and loss. From this latter account, provision has been made for interest on debentures, income-tax, loss on exchange and bad and doubtful debts, and £1288 has been written off capital expenditure for depreciation. The sum of £2000 has been transferred to the reserve account, which now stands at £72,000; and £500 has been added to the insurance fund, increasing it to £12,000. The balance then remaining at the credit of profit and loss available for dividend is £33,567. Of this the Directors paid an interim dividend of 10s. per share, less income-tax; and they now recommend the payment of a further amount of 10s. per share—making together a dividend of 5 per cent. for the year. This will absorb £27,096, and leave a balance of £6471 to be carried forward. In spite of the almost entire absence of any revival in the trade of Monte Video during the year, the net result on the revenue account is £365 better than in 1892.

West Worthing Water Supply.—In the course of last summer, the West Worthing Water-Works and Baths Company commenced erecting works for the storeage of the water pumped from their borings. The reservoir has now been completed and brought into use. On the occasion of its inauguration, the Chairman of the Company (Mr. Horatio Brandon) entertained a small party at luncheon, and gave a few particulars as to the works, the Engineers of which are Messrs. J. Quick and Son. Mr. Joseph Quick, who was present, also furnished some technical details. He explained that they had laid a main 4 miles long to the reservoir, situated at Coate, and at a level of 125 feet above the sea; and with it they would, he said, obtain a sufficient pressure to reach the top storey of the highest house in West Worthing. As much as 7 per cent. of the water was taken in one hour during the time of maximum demand; while at other times the draught was small. He alluded to the excellent manner in which the Contractor (Mr. W. W. Smith) had carried out his work. At the close of the luncheon, the party drove to the new works. The reservoir is 40 feet square and 15 feet in depth. It has a capacity of 150,000 gallons, or 1½ days' supply. Chalk was met with about 3 feet from the surface; and the concrete base of the reservoir was laid in this material—an embankment around the excavation bringing the total depth, as stated, to 15 feet. Iron pillars and girders support a concrete roof—an arrangement which has the advantage of economy in cost and space over the old form of brick arched roof. By an ingenious valve attachment, only one length of mains is necessary. The water is pumped into, and flows out of, the reservoir by the same pipe, which is 7 inches in diameter. The intermediate villages are supplied from this main, which in some places is as much as 22 feet below the surface.

METROPOLIS WATER SUPPLY.

The Quality of the Water during April.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 195,423,634 gallons, as compared with 193,915,760 gallons in the corresponding month of 1893. The number of services being 804,363, the rate was 243 gallons to each service. Of the entire bulk of water sent out, 99,850,387 gallons were drawn from the Thames, and 95,573,247 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies was: Kent, 0·7; Tottenham, 1·1; New River, 1·2; Southwark, 2; Colne Valley and East London (deep well), 2·1; East London (river supply), 2·3; West Middlesex, 2·4; Lambeth, 2·5; Grand Junction, 2·7; and Chelsea, 2·9. The unfiltered river water contained the following proportions: Thames at Hampton, 4·3; New River Cut, 2·2; Lea at the East London Company's intake, 3·3. The Thames at Hampton was turbid and yellow on April 13. It was, however, both chemically and bacterially, of very much better quality than on the 13th of March, when the previous sample was taken. As delivered by the five Companies drawing from the river, it was of excellent quality; ranking, in the case of the Southwark, with the deep-well waters in respect of organic impurity. It was in every case efficiently filtered, and exhibited the following percentage of bacterial improvement: Chelsea, 99·6; West Middlesex, 99·6; Southwark (average of two filters), 97·86; Grand Junction, (Hampton filters) 94·05, (Kew filters, average of two) 99·09; and Lambeth, 98·41. The New River Cut on the 16th of April was turbid and pale yellow in colour; but otherwise it was of very good chemical quality. After passing through the subsidence reservoirs, it was also of excellent bacterial quality. It was efficiently filtered before delivery; and was improved bacterially to the extent of 98·92 per cent. in the main filter well, and 99·46 per cent. in No. 1 well; while the water delivered into No. 4 well was quite free from microbes. It was absolutely sterile. The raw river water of the Lea, at the East London intake at Angel Road, was on the same day turbid and pale yellow, but otherwise of good chemical quality. Bacterially, however, it was much inferior to the Thames at Hampton. It was efficiently filtered before delivery, and much improved in chemical quality, while 99·71 per cent. of the microbes were removed from the water supplying the No. 1 Essex well, 98·01 per cent. from that issuing from No. 11 bed, and 94·03 per cent. from No. 12 bed. The deep-well waters of the Kent, Colne Valley, Tottenham, and East London Companies were of excellent quality for dietetic purposes; the East London Company's supply being, however, slightly turbid. The rest of these waters were clear and bright without filtration; and the Colne Valley Company's water was softened before delivery, and thus rendered suitable for washing. The Kent Company's water was again distinguished for its high degree of organic purity. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless; the East London (deep well), slightly turbid and colourless; the New River, clear and nearly colourless; and the rest of the waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters, and of those supplied by the various Companies, collected on the 13th, 14th, 16th, and 17th of April, gave the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw and Stored River Waters.		
Thames at Hampton	2520	14·0
„ after storeage for 13 days (Chelsea Company)	1170	12·5
Gravel water (Southwark Company)	230	9·6
New River Cut before entrance into reservoirs	2220	11·7
New River Cut after passing through reservoirs	460	12·7
Lea at Angel Road	4020	11·8
„ after storeage for 15 days	1420	12·2
Thames.		
Chelsea	10	12·9
West Middlesex	10	12·8
Southwark, No. 4 well, Hampton	22	11·7
„ „ 8 „ „	86	13·9
Grand Junction (Hampton general well)	150	12·8
„ (Kew general well)	24	13·2
„ (Kew south well)	22	14·2
Lambeth	40	13·2
Lea.		
New River, main filter well	24	12·7
„ No. 1 well	12	12·6
„ No. 4 „	0	12·8
East London, No. 1 Essex well	12	12·0
„ No. 11 bed	80	12·0
„ No. 12 „	240	11·8
Deep Well.		
Kent	7	11·4

In the course of their report for the past month to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.), Messrs. Crookes and Odling say: Of the 175 samples examined, two were recorded as "clear, but dull," and one as "slightly turbid." The remainder were clear, bright, and well filtered. The rainfall in the Thames Valley during the month of April came very close to the average. The actual fall at Oxford was 1·7 inches; while the average for 25 years is 1·78 inches—showing a deficiency of only 0·08 inch. The rain was pretty evenly distributed over the month—the second half being a little wetter than the first half; but the downfall came in the form of gentle showers, which soak into the ground, and do more good than twice the amount of rain falling at longer intervals, and rushing over the land to the nearest watercourse to the sea. The Thames-derived waters are now of a high degree of purity, and may be considered to have assumed

their summer characteristics. Active vegetation, increasing temperature, and abundant light, promote oxidation, and reduce the dissolved organic matter to a low point; while the lowering of the brown constituent in the colour-meter is a further proof of the diminishing amount of organic carbon present. The following comparison between the different constituents in the March and April waters will show the changes since the last report:—

Averages of the Five Supplies derived from the River Thames.

	Common Salt per Gallon.	Nitric Acid per Gallon.	Hardness, in Degrees.	Oxygen required per Gall.	Organic Carbon per Gall.	Organic Carbon per Gall.
March.	2·285	1·101	15·32	0·052	0·121	0·162
April.	2·100	0·995	15·00	0·034	0·076	0·108

Note.—All the figures are means except those in the last column, which are maxima.
Colour.— March, 21·3 brown to 20 blue; April, 14 2 brown to 20 blue.

The Additional Capital for the West Ham Gas Company.—In accordance with the announcement which appeared in our advertisement columns, Mr. Alfred Richards sold last Thursday, at the Mart, Tokenhouse Yard, £10,700 of perpetual 4 per cent. debenture stock, and 800 £10 shares in the West Ham Gas Company. The former produced £11,280, and the latter £8776.

Sales of Stock and Shares.—Messrs. W. Bush and Son, of Sheffield, publicly disposed of some stock and shares in the *Sheffield United Gas Company* last Tuesday at the following rates: £125 of "A" stock, at £220 10s. per cent.; £332 10s. of "B" stock at £218 5s. per cent.; £256 10s. of "C" stock, at £218 5s. per cent.; 15 new ordinary £6 "D" shares (£3 paid), at £7 15s. each; and 25 new ordinary £3 "F" shares (12s. paid), at £2 4s. apiece.——At Durham recently, a number of £5 shares in the *Consett Water Company* changed hands at £8 10s. to £8 12s. each; and some "C" shares in the *Hartlepool Gas and Water Company* also realized the last-named figure.——Twenty first preference shares in the *Lowestoft Water and Gas Company* have lately been sold at an average price of £9 1s. 3d., and 36 second preference shares at an average of £8 16s. 3d.

New Orders for West's Machinery.—The South Metropolitan Gas Company have decided to adopt stoking machinery at their Vauxhall works, and have placed an order with West's Gas Improvement Company, Limited, for a complete set of machinery, on their compressed-air system, suitable for working five-tier retorts. This is the second order for stoking machinery which the South Metropolitan Company have placed this year, as the West Company have now in course of construction a complete installation for the Old Kent Road Gas-Works. The Cheltenham Gaslight and Coke Company have also decided to extend the use of West's stoking machinery to their new retort-house, and have given instructions for the preparation of a complete set of machinery, upon the "manual" system, similar in most respects to that which has been in operation in one of their present retort-houses for the last eight years.

The Water Scheme for Dublin Out-Townships.—The application of the Kingstown Township Commissioners for a Provisional Order, empowering them to carry out a scheme for supplying the township independently or conjointly with other districts, has not been successful. In the course of a letter announcing their decision, the Local Government Board for Ireland say: "It appears that the supply of water given by the Dublin Corporation to Kingstown has proved sufficient from 1870 to 1893 during the varying weather that occurred in that period; and it further appears that the failure to supply the full daily quantity last autumn was caused by the unprecedented dryness of the season. The Local Government Board, having given very full and anxious consideration to the subject, and having taken advice upon the legal aspect of the question, are advised that the extraordinary drought of last year was an 'unforeseen accident' within the meaning of the Kingstown Act of 1869, and that section 41 of that Act is still in force and binding both on the Kingstown Commissioners and on the Corporation of Dublin; and consequently the Kingstown Commissioners could only obtain an independent water supply by that section being first repealed. After mature consideration of the report on the inquiry and the evidence given thereat, the Board have come to the conclusion that they ought not to make a Provisional Order to repeal that section; and they therefore feel unable to accede to the prayer of the petition."

Exhibitions of Gas Appliances.—An interesting exhibition of Messrs. W. Parkinson and Co.'s gas cookers and heating appliances was held in the Oldbury Town Hall, in connection with the Local Board Gas Department, from Tuesday to Friday last. It was formally opened on Tuesday afternoon by the Chairman of the Gas Committee (Mr. J. W. Wilson.) Miss E. Sanderson gave practical lessons on cookery each day before numerous audiences. The exhibition, on the whole, was very successful.——In the Northumberland Hall, Newcastle-upon-Tyne, last week, Messrs. J. Wright and Co., Limited, had on view an excellent collection of their cooking and heating stoves, the qualities of which were demonstrated by Miss Shaw. This week the firm are exhibiting at Gateshead.——Last Tuesday, an exhibition of gas appliances of Messrs. R. and A. Main's manufacture, was opened in the Lesser Clark Town Hall, Paisley, by Provost M'Gown. Miss Burden gave cookery lectures twice daily.——The Gas Department of the Dukinfield Local Board held an exhibition of gas stoves and other appliances last week. The stove exhibits were furnished by Messrs. Fletcher, Russell, and Co.; and Miss Edith Roberts gave practical illustrations of the best manner of using them in domestic culinary operations.——The Davis Gas-Stove Company, Limited, held an exhibition of gas appliances at Canterbury last week, with the co-operation of Mrs. Hunter as lecturer.——An exhibition of gas-stoves, fires, &c., was held in the Music Hall, Bideford, from the 1st to the 4th inst., when lectures were delivered by Miss Silcox, daughter of Mr. J. H. Silcox, the Manager of the Pembroke Docks and Town Gas Company.——In the Agricultural Hall, Oakham last week, Messrs. Arden Hill and Co. held, for the Oakham Gas Company, an exhibition of gas appliances. The arrangements were carried out under the supervision of the Company's Manager (Mr. J. Mason); and they included cookery lectures by Miss Alice Leng.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The coal troubles of last year greatly disturbed contracts, as we all know; and resulting from that there is already a large crop of litigation. The latest case is one which was before Lord Low in the Court of Session this week, in which the Trustee of the estate of Robert Forrester, coal merchant, of Glasgow, sues James M'Kelvie and Co., coal merchants, of Edinburgh, for £112 10s., as balance due upon a contract. The contract was for the delivery of the estimated output of 5000 tons of Forrester's Roughrigg (Blackbraes) Cannel. The defence is that from November, 1893, to February of this year the miners who worked the cannel in the pursuer's pit were locked out, because they refused to work for a lower wage than the rate current at the time; that consequently no cannel was delivered in that time; and that it was necessary for the defenders to purchase cannel elsewhere. They did so at an enhanced price of 2s. 3d. per ton, which upon 1000 tons entailed upon them a loss of £112 10s.; and this sum they deducted from the amount due by them. The reply of the pursuer is that a strike existed, during which time it was impossible to deliver coal, and that the strike was a sufficient cause of exemption from delivery. The question in dispute is therefore virtually whether there was a strike or a lock-out—not a very difficult one to settle; but there will likely be a stiff fight over it, if it should go to trial.

The newspaper controversy over oil gas has not made progress this week. Only one letter appeared in the *Glasgow Herald*, on Tuesday, in which J. K. returned to the subject of the cost of oil for gas purposes. His contention is that, when it becomes necessary to use American or Russian oils, the price will be so high that gas manufacturers will turn to coal again. Coal yielding 10,000 cubic feet of 18-candle gas, he says, has been supplied at an average price of 8s. per ton, which enables gas to be made at 6d. per 1000 cubic feet, and leaves the tar and ammoniacal liquor over to pay the cost of the manufacture. He can understand that in gas-works where they have to pay from 7s. to 10s. per ton for railway carriage, they might go in for oil; but for places like Glasgow or Edinburgh, which are in the centre of the coalfields, it is out of the question. The statement is a plausible one; but it lacks force, because it ignores a very important consideration—whether consumers in either Glasgow or Edinburgh would be content with gas of only 18-candle power. I do not think they would.

The Arbroath Gas Corporation on Tuesday sold their secondary products for the current year at 4s. 1d. per 100 gallons of tar and liquor mixed. Last year the price was 3s. 9d. per 100 gallons; so that there is an increase of 4d. At the close of the meeting of the Corporation, the Manager (Mr. R. S. Carlow) exhibited a prepayment meter, and explained its working. There is a probability of a trial being given to these meters in Arbroath.

The Ardrossan Gas Commissioners are about to extend their works. Of late years, the town has been coming forward, on account of the improvement of railway communication to it. The extension is to take the form of the introduction of oil-gas plant; and the Commissioners have let the contracts for the execution of the work—the cost to be £795. I do not know what system is being adopted.

The Stonehaven Gas Company held their annual meeting on Monday, and declared their customary dividend of 2s. 6d. per share. Since last year, when it was 4s. 7d. per 1000 cubic feet, the price of gas has been twice reduced, and it is now 4s. 2d., which is claimed to be the lowest figure in any town north of Dundee. From that, however, Aberdeen must be excepted, so that the local assumption is so far wrong, as, in my experience, it often is.

The unfortunate flood of last October, by which damage was done to the Witchden Tunnel in Brechin, for the maintenance of which the Gas Company are liable, has given rise to questions between the Company and the town which are not yet settled. One of these has reference to the charge for gas consumed by the public lamps, which the Police Commissioners have mixed up with the way-leave for pipes. They discussed the subject for more than an hour at a recent meeting; but they did nothing more than send both subjects to Committees for further consideration. The proposal made was that the Company should, in respect of the way-leave, light 45 of the leading lamps free. This would be equal to a contribution of £54 a year to the town. That is certainly a very big rent to pay in a town of the size of Brechin; and, if no other consideration enters into the arrangement, the Company can scarcely be expected to agree to it. He must be a poor financier who made the proposal, because the £54 contributed by the Company would come out of the pockets of the gas consumers—that is to say, of the inhabitants—and therefore the benefit to the town would be nothing. As regards the tunnel itself, which is a conduit for the conveyance of water, the opinion of Mr. Blackadder, of Dundee, as to its reconstruction, was read. He was of opinion that an old watercourse, if cleaned out, might relieve the pressure upon the tunnel, and prevent flooding. This, he thought, could be done for £220. He preferred, however, that a new conduit should be made along the public road, which would cost £450. The Board agreed to await the proposals of the Company. When the accident to the tunnel happened, the Burgh Surveyor estimated that the cost of repairs would be £700; and the Company offered to contribute £250 of this sum. The Police Commissioners and the Managers of a United Presbyterian Church, who are also interested, offered to contribute together £150. The two sums only amounted to little more than half the estimated cost; and consequently the negotiation dragged—the opinion of Counsel being taken jointly, as to who were liable for the reconstruction. This opinion, being joint, has not been made public; but it would seem to have indicated that the Commissioners have a considerable liability as well as the Company. Now, however, when the estimate is only £450, there should be little difficulty in coming to a settlement. With regard to the introduction of electric lighting, which is another subject upon which the Commissioners are deliberating, and which may also arise out of the differences with the Company, an interesting incident took place on the above-named occasion. It was moved that a Committee be appointed to inquire into the cost of obtaining a Provisional Order and then Mr. Murray moved that they take no further action. In

supporting his motion, he gave the information (where derived, he did not mention) that he understood Montrose had come to its senses, and was to go no further in the introduction of electric lighting. "The opinions," he went on to say, "of electrical engineers were of no great value, as they were interested in getting installations carried out in as many towns as possible. But when they found that places where the light had been introduced had regretted that it had been done, the Council should pause before committing the town to an expenditure of £25,000 in carrying out a scheme." The sentiment is a very sensible one; but I should have liked if Mr. Murray had mentioned any place where the inhabitants regretted introducing electric light. Without this, the statement is of little use. If he could give the information, it would be of great value, in view of the persistent efforts which are being made by electricians to thrust themselves in so many towns. Mr. Murray received no support; but that is not to be wondered at when the motion he was opposing was one for inquiry, and when the principal object of the Commissioners is to ascertain how they can best keep out a private company, as was implied by one of the speakers.

It is matter of common knowledge in the gas industry that meters are not altogether reliable recorders of the quantity of gas they pass. Apparently this knowledge has been denied to some Police Commissioners or public officials, at least in Largs. In that town, at the last meeting of the Commission, a letter from the Burgh Treasurer was read, in which he called the attention of the Commissioners to discrepancies in the quantities of gas registered by the meters upon the public lamps. One of these had given, in the past year, 5400 cubic feet, as compared with 3400 feet in the previous year; another gave 4100, as compared with 3100; and a third gave 3700, as compared with 6900. It appears as if the meters were in need of an overhaul; but the Commissioners' minds seemed to run in another direction, because, instead of seeking to have them put right, they resolved that the meter indices should be examined, and that in future someone should read the meters along with the Gas Company's checker. It will be observed that the Gas Company did not profit to any great extent by the readings; and it cannot therefore be to their interest to maintain inefficient meters. In the interests of both parties, the proper course would have been to have first of all seen to the meters instead of the man who reads them.

Sulphate of ammonia is reported to be selling at as high as £14 2s. 6d. per ton for spot delivery; but the increased price is going chiefly to contractors, there being very little in the hands of manufacturers that is not secured upon long contracts.

The Edinburgh and District Water Trust on Thursday appointed Mr. James Wilson, C.E., to be Engineer to the Trust. There was a long discussion upon a proposal to appoint a Resident Engineer instead of, as the arrangement is, a consulting one; but the proposal was rejected by an overwhelming majority. Mr. Wilson's appointment requires him, for a fixed salary, to attend to all the ordinary engineering work of the Trust; and for new work he is to receive commission at a rate not exceeding 2½ per cent. on the cost. He is also at liberty to undertake work for local authorities outside the area of the city. The question which was raised at the former meeting as to the ownership of plans and documents prepared by the Engineer for the Trust, was easily disposed of; a letter having been received from the firm of Messrs. J. and A. Leslie and Reid, stating that they had all along recognized that all such plans and documents were the property of the Trust, and that, in the event of Mr. Wilson receiving the appointment, the same arrangement would hold good. Mr. Wilson is to be congratulated on his stepping into so important a post within a few months of leaving Greenock for Edinburgh. To all appearance, too, the Trust are to be congratulated upon securing the services of so competent an engineer and so affable a gentleman.

The Water Committee of the Glasgow Town Council have resolved to recommend that the domestic water-rate within the city should be fixed for the current year at 6d. per pound, the same as it has been for some time. It is estimated that the revenue for the year will be £176,881; and the expenditure, £176,269. On the past year, it is expected there will be a balance of £11,278.

A new scheme of water supply for the towns and villages in the higher portion of Linlithgowshire is nearing completion. A reservoir has been constructed about eight miles to the west of Bathgate, of a capacity of 100 million gallons; and the pipe-line extends as far east as Broxburn—serving on the way, besides the town of Bathgate, every village on the route. Messrs. J. and A. Leslie and Reid are Engineers of the scheme. The promoters are the County Council of Linlithgow; and the formation of this system is another illustration of the benefits rural populations enjoy under the Local Government Act.

Additions at the Windsor Water-Works.—Within the last few months, the Corporation of Windsor have found it necessary to make some additions to the water-works. The long and severe drought of last summer greatly taxed their resources, although no want of water was at any time suffered. But to provide against unforeseen contingencies, it has been deemed advisable by the Water Committee to sink a new well; and the work is to be carried out under the superintendence of the Manager (Mr. C. Sainty). It is estimated that the new well will produce 300,000 gallons of water per day. The cutting of the first sod was performed by the Mayor last Thursday.

Rawmarsh Local Board Gas-Works.—The financial statement of the Gas Department for the year ending March 25 last was submitted at last Wednesday's meeting of the Rawmarsh Local Board. It appeared that the gross profit amounted to £1466; being a decrease of £175. The net profit was only £122, which was a drop of £331. This, however, was nearly accounted for by the heavier loan charges and the reduction in the price of gas by 3d. per 1000 cubic feet during the past six months. The loan charges in 1892-3 were £1188; and in 1893-4 £1344—an increase of £156. The lower price of gas also represented a reduced income of £143 in the half year. The members considered that a great deal of credit was due to the Gas Manager (Mr. Watson) for the successful working of the concern; and a resolution thanking him for his services was passed.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 26.

Sulphate of Ammonia.—During and ever since the holidays, the market has displayed great activity, which is, of course, in conspicuous contrast with the calm of former times. In consequence, the market has been advancing steadily; and to-day marks about £1 per ton advance on the closing prices of April. There has been eager competition for all parcels offered for sale; and if the bulk of the supplies has been secured by dealers, it is not because consumers have no requirements. The latter, while bewailing lost opportunities and realizing a mistaken policy, appear again to have adopted a waiting attitude; meantime allowing middle men to take advantage of the position. Stocks seem well cleared throughout the country; the production is getting small; and there will eventually be great difficulties in securing supplies. £14 is now generally quoted. Nitrate is dull, at about 9s. 4½d.

LONDON, *May* 26.

Tar Products.—There is a good deal more inquiry for carbolic acid; and the value is distinctly firmer. Anthracene is also showing more life; makers evidently being anxious to buy against the important improvement in deliveries of alizarine since the settlement of the Russian tariff. The outlook in anthracene is decidedly brighter; and it would not be surprising if the Tar Products Sales Committee, at their next meeting, raise the price, at any rate, of "A" quality. Benzols are flat. Stocks, however, in makers' hands are extremely low. Any improvement in the aniline trade, which may happen at any time, should commercial matters settle down in America, would reflect itself immediately on the price of benzols. There is a "squeeze" on for pitch; and dealers are making the most of their opportunity. Pitch consumers, both abroad and here, are well off for the article; and the pressure being put upon distillers by dealers has simply resolved itself into an effort at getting something for non-delivery during the shipping season. This is doubtless at the bottom of the increased prices now quoted. Values are as follows: Tar, 13s. to 17s. Pitch, 27s. 6d. Benzols, 90's, 1s. 1d.; 50's, 1s. 4d. Solvent naphtha, 1s. 2d. Creosote, 1¼d. Creosote salts, 20s. Toluol, 1s. 7d. Cresylic acid, 1s. Crude benzol naphtha, 30 per cent., 5½d. Carbolic acid, 60's, 1s. 8½d. Anthracene "A," 1s. 2d.; "B," 10½d.

Sulphate of Ammonia.—The improvement in this article continues; and to-day's value in all positions is certainly under £14, less the usual discount. Considerable business is being done; and excellent prices are now offered for next season's delivery. The improvement in nitrate of soda probably has something to do with the important advance in sulphate during the last two weeks. Gas liquor is quoted at 10s. to 12s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The gas coal season seems now to be fairly opening; and the anxiety on the part of colliery owners with regard to the prices they may be able to command is evidenced by the recurring conferences which are held for the purpose of discussing and considering the position. One of these conferences between representatives of Lancashire and Yorkshire gas coal collieries was held in Manchester last week; and so far as I can gather, there is still a determination to hold out for an advance of something like 1s. per ton upon the prices which had to be taken last year. This, however, where contracts have already been placed, has not in all cases been obtained; the prices which, I hear, have so far been accepted averaging about 6d. to 9d. per ton above last season's excessively low figures. Whether anything like a determined stand will be made in holding out for the advance of 1s. per ton, which would bring prices to about the level of those ruling in 1892, remains to be seen. With regard to other descriptions of round coal, the market remains in much the same depressed condition that has been reported of late. Notwithstanding the protracted stoppages of the pits for the recent holidays, the supplies upon the market are largely in excess of requirements; and short time is again prevalent, with stocks accumulating. Official quoted rates are unchanged; the district meetings, and also the meeting of the Council of the Lancashire Coal Sales Association, deciding that no move should at present be made with regard to any further giving way. The principal colliery firms in the Manchester district are also holding to their late rates. In the open market, however, there is a good deal of undercutting by collieries outside the Coal Sales Association; and coal from other districts continues to be pushed here at very low figures. The average quoted prices remain at about 11s. and 11s. 6d. to 12s. in special cases, for best Wigan Arley; 10s. to 10s. 6d. for Pemberton four-feet and seconds Arley; 8s. to 8s. 6d. for common house-fire coals and gas-making coals; and about 7s. 6d. to 8s. per ton at the pit's mouth for steam and forge coals. For shipment, the demand continues very unsatisfactory; and although 8s. 6d. remains the minimum official quotation for Lancashire steam coal delivered at the ports on the Mersey, sellers in some cases have been taking 3d. to 6d. under this price. Engine classes of fuel meet with a fair demand; but supplies are ample for all requirements, and prices are not more than steady at something like late rates. Slack averages about 5s. to 6s. per ton, according to quality; burgy, about 6s. 6d. to 7s.; and through-and-through coal, about 6s. 9d. to 7s. 3d. per ton at the pit's mouth.

Northern Coal Trade.—There is a rather weaker tone in the coal trade generally, though one or two kinds are a little more in demand. The shipping season has now fairly set in; and there is a tolerably good amount of coal being sent out. But the inland demand is still very limited, and seems likely to be for another month. Best Northumbrian steam coals are still nominally quoted 10s. per ton f.o.b.; but there have been sales at a little lower, and possibly 9s. 10½d. might represent the nearer rate to actual transactions. Second qualities are 1s. per ton less; and steam smalls are steady at from 4s. 6d. to 4s. 9d. per ton, the demand being good for this class of coal. Most of the

steam coal collieries are working fairly well. For gas coal, there is a better demand for export; but the home inquiry is still rather limited, though fair shipments to London continue to be made. The price still asked by the collieries in the combination is 7s. 3d. per ton f.o.b.; but pits outside take lower rates. There is very little alteration in the prices of coal for manufacturing purposes; but the demand is not so pressing as it was, and strikes in the engineering trade are rather limiting the consumption. Smithy coal is more in request, especially for shipment. Coke is rather steadier; the price being from 13s. to 14s. per ton f.o.b. Gas coke is not so plentiful; shipments being larger. But there seems to be less used in the cement factories. There is no alteration in the price this week.

Scotch Coal Trade.—In Scotland there is a fair amount of business doing, but prices are tending to be easier; the reduction in miners' wages leading purchasers to stand out for better terms. The masters would seem thus to have secured their object in making the reduction, which was to induce more demand. Ell coal is still in most request; and it is said that orders have been booked which ensure a good outlet for it for a considerable time. Splint is plentiful, with prices tending downwards. Steam coal is dragging; the iron market being dull. Main is only in fair request; and prices for it are easier. This week shipping prices in the East have been lowered, which should have the effect of bringing round wavering customers. In the eastern districts, too, the masters have given notice of a reduction of miners' wages to the rate at which they stood prior to the last two advances, thus following the example of the West and Fifeshire. The prices quoted are: Main, 6s. 10d.; ell, 8s. 3d. to 8s. 6d.; splint, 7s. 6d. to 7s. 9d.; and steam, 9s. per ton f.o.b. Glasgow. The shipments for the week mysteriously show an increase; having amounted to 152,795 tons—an increase over the previous week of 23,992 tons, and over the corresponding week of last year of 9514 tons. For the year to date, the total shipments have been 2,743,376 tons—an increase over the same period of last year of 344,527 tons.

Reduction in Price by the Brentford Gas Company.—At the meeting of the Hammersmith Vestry last Wednesday, the Clerk read a letter from the Secretary of the Brentford Gas Company, stating that, after the taking of the meter indices for the quarter ending the 24th prox., the price of gas supplied by meter and to the public lamps would be reduced 2d. per 1000 cubic feet.

The Position of the Leicester Corporation Water Supply.—The stock of water in the Leicester reservoirs has decreased to the extent of 50,000,000 gallons during last month. The rainfall from April 30 to May 21 was only 0·94 inch at Thornton and 0·89 inch at Bradgate; and for the whole year it amounts to only 6·27 inches at Thornton and 7·07 inches at Bradgate. The water delivered to the consumers during April was 12·63 gallons per head per day, as compared with 17·59 gallons last year. The new Ellistown supply is now yielding 400,000 gallons a day; and from a couple of shafts sunk at Swithland, on the site of the new reservoir, about 500,000 gallons a day is obtained, which is considered very satisfactory. No Corporation water is allowed to be used in the streets; water from the river and various deep wells being utilized for flushing the sewers and watering the streets. Some £4000 has been spent by the Highway Committee in constructing tanks for storing water from wells for this purpose.

Obtaining Coke by Fraud at Great Yarmouth.—At the Yarmouth Police Court, on the 11th inst., Alfred Driver and Samuel Balls, labourers, were charged by Mr. W. J. Carpenter, the Engineer and Manager of the Great Yarmouth Gas Company, with obtaining by fraud a large quantity of coke during the last three months. The principal charge was against Driver, who had altered orders (issued from, and paid for at, the Company's office) for 1 cwt. of coke to 4 cwt. In all 109 tickets had been tampered with in this way; so that altogether 16 tons 7 cwt. of coke had been obtained, which was valued at £13 12s. 6d. A test ticket was prepared on the 9th inst. by a clerk, which got into the hands of Driver, and was also altered in the same way. This led to his arrest on the following day. The prisoner Balls was connected with the case from the fact that he was in charge of the barrow upon which the coke was placed. The prisoners were remanded. The case again came before the Court on the 18th inst., when the Bench were asked to take a charge against Driver of forging and uttering four coke orders on the 5th of May, one on the 7th, and one on the 10th. In each instance, the order was issued for 1 cwt. of coke, and was afterwards altered. Evidence referring to these particular cases was given; and Driver was afterwards committed for trial at the Norwich Assizes. Balls, against whom there was not sufficient dence upon which to commit him, was discharged.

Electric Lighting Works for Wolverhampton.—On Monday last week, the Mayor of Wolverhampton (Mr. Alderman Mander) laid the foundation stone of the new works now being erected by the Corporation as the head generating-station for the supply of electric light in the borough. The necessary cables are being laid for furnishing the light in a certain area, including the principal streets in the centre of the town. The initial cost of the works and plant is estimated at £30,000. A shareholder in the Wolverhampton Gas Company writes on the subject as follows to the *Birmingham Gazette*: "May I point out what a beautiful thing it is to see our Corporation embarking in the electric lighting speculation. To start with, they have borrowed £30,000 on the security of the rates, to which the Gas Company are large contributors. Thus they are actually making us provide the money to set up an opposition to ourselves, to reduce our income, and to depreciate our property. The Corporation says to us in effect: 'Give us your money, or we will put in the bailiffs. We will use it to start a business in competition with yours. We shall do our best to take away your customers, and thereby your living—that is, if we succeed. But if we fail, we shall throw the loss upon you by charging it to the rates!' It is, however, quite on the cards that we may be ground by both the upper and the lower millstone; that the Corporation may take away a certain amount of our trade, impoverishing us that way and, finding their venture a failure, be obliged to charge the loss to the rates, impoverishing us still further in that way. And, indeed, it is most likely that they will thus compass the double event."

Bahia Gas Company, Limited.—The accounts of the Bahia Gas Company for the past half year show a profit of £6123, after writing off £5690 on exchange account. Including the amount brought forward, there is an available balance of £10,847, which permits of the distribution of a dividend at the rate of 8 per cent. per annum, and the carrying forward of £4606. In regard to the negotiations with the authorities for the transfer of the works, a telegram has been received to the effect that, upon deposit of the indemnity in promissory notes, the works have been handed over to the State authorities.

Rejection of the Church Stretton Water Scheme at Shrewsbury.—Voting papers were recently sent to every owner of property and ratepayer in Shrewsbury, with a statement drawn up by a Committee of the Town Council with reference to the scheme for obtaining a supply of water from Church Stretton at a cost of £120,000; and those entitled were asked to vote for or against the scheme—the Council having declined to accept the responsibility of deciding the question themselves. The papers were returned and counted last week, when it was found that 1144 had pronounced in favour of the scheme, and 4435 against it.

Gas v. Steam for Pumping Purposes.—Since the separation of the two towns of Malton and Norton, the question of the great cost of the old steam pumping-engine at the water-works has become a most serious one for the Board of Health and the town. Norton went in for a new water supply of its own, and put down a gas-engine for pumping purposes; and now, after a year's working, Mr. Henry Tobey, the Manager of the Malton Gas-Works, has brought the whole subject before the Malton Board, and forms a striking comparison. He says: "The cost of gas at Norton for the whole twelve months has only amounted to £38 18s. 6d.; and for engine man, £31. The latter item might have been reduced to £15, as it is not necessary to give constant attention to the engine. The cost of coals for Malton during the same twelve months has amounted to £256 1s. 6d.; and engine man, repairs, oil, waste, rent, boiler insurance, &c., £273 15s. 7d.—a total of £529 17s. 1d." The Gas Company have offered to put down for the Board a gas-engine and efficient set of pumps for £473; and Mr. Tobey claims "that the economy which would take place would soon repay the first outlay, and afterwards leave a nice margin of profit for public improvements or relief of rates."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1010.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	12 Apl.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p.c.	10	12—13	..	5 15 4
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
100,000	20	14 Dec.	8	Bahia, Limited	20	10—11	..	14 10 10
200,000	5	11 May	6½	Bombay, Limited	5	5—5½	..	5 18 2
40,000	5	,,	6½	Do. New	4	4—4½*	..	5 15 6
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	167—172	..	4 18 10
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	210—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	109—112	..	4 9 3
320,000	20	29 Mar.	11½	British	20	45—47	..	4 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	16—17	..	5 0 0
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5½-6½	..	3 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	12 Apl.	12½	Commercial, Old Stock	100	252—257	..	4 17 3
165,000	,,	,,	9½	Do. New do.	100	190—195	..	4 17 5
160,762	,,	14 Dec.	4½	Do. 4½ p c. Deb. do.	100	132—137	..	3 5 8
800,000	Stck.	14 Dec.	13	Continental Union Limited	100	235—240	..	5 8 4
200,000	,,	,,	10	Do. 7 p. c. Pref	100	205—210	..	4 15 3
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	105—110	..	4 10 11
486,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15½—16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	225—230	..	5 4 4
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	100—104	..	3 16 11
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 12 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	192—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	175—180	..	3 17 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	272—277	..	3 12 3
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	,,	,,	6	Do. 6 p. c. do	100	177—182	..	3 5 11
3,800,000	Stck.	11 May	12	Imperial Continental	100	215-220*	..	5 9 1
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	100	109—111	..	4 10 1
541,920	20	15 Nov.	5	Monte Video, Limited	20	13½—14½	..	6 18 0
150,000	5	30 Nov.	8	Oriental, Limited	5	5½-6½	..	6 8 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	5½-6½	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1½—2½	..	3 17 9
420,000	100	2 May	6	People's Gas of Chicago—1st Mtg. Bds.	100	102—107	..	5 12 1
500,000	100	1 Dec.	6	and Do.	100	97—102	..	5 17 8
150,000	10	26 Apl.	6	San Paulo, Limited	10	9½-10½	..	5 14 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	317—322	+2	4 16 3
1,350,000	,,	,,	12	Do. B do.	100	260—265	+2	4 10 6
260,000	,,	,,	13	Do. C do.	100	265—270	+3	4 16 3
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	153—157	..	3 3 8
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	277—282	..	3 10 11
1,720,252	Stck.	12 Apl.	8	East London, Ordinary	100	223—228	−2	3 10 2
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	117—120	+1½	3 10 10
708,000	Stck.	28 Feb.	11½	Kent	100	290—295	..	3 17 11
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	253—258	−2	3 13 7
406,200	100	,,	7½	Do. 7½ p. c. max.	100	203—207	..	3 12 5
330,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	365—370	−2	3 5 6
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	162—165	+1	3 12 9
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	270—275	−1	3 12 9

*Ex div.

Municipal Contracts in Manchester.—Some time ago, the Corporations of Manchester and Salford adopted resolutions declaring that no contracts should be let to firms who do not pay the "standard" rate of wages. Judging from discussions that have taken place since then at meetings of the Councils of the city and borough, and in the correspondence columns of the newspapers, it has not been found possible or desirable to carry out the resolutions to any very great extent. This is apparently the view taken by the Manchester and Salford Trades and Labour Council. At a meeting of that body last Thursday night, the subject was brought under notice in the form of a motion in the following terms: "That a Committee (to be called the Municipal Contract Inquiry Committee) be appointed from this Council, whose duty it shall be to make inquiry into, and obtain all possible information concerning, impending municipal contracts in Manchester and Salford; to supply the Corporation Committee with a list of fair shops in the trade or trades affected by such contracts, and any other information necessary. From time to time they shall report to this Council, to enable them, either by a general vote or through its Executive Committee, to take such steps as may be deemed advisable." In the course of the discussion, it was stated that "the Council might be surprised to learn that the whole of the vast system of electric light mains of the Corporation was laid down by non-union labour; that the central electric light station of the Corporation was run by non-union labour; and that the rate of wages varied from 4d. to 8d. an hour—only two or three, however, getting the 8d. The average was about 6d." It was further represented "that the gas tank in Rochdale Road was let by contract, although there was nothing to prevent the Corporation doing the work themselves, and employing their own men upon it;" and it was urged that a strong effort should be made to secure the repeal of the rule of the Gas Committee which provides that all work entailing an expenditure of more than £50 must be contracted for. The motion was adopted with an alteration extending its scope to the contracts of all public bodies.

Lambeth Water-Works Company.—The report of the Directors of this Company for the half year ended March 31 last states that during this period 1007 houses and other supplies of water, estimated to yield an annual rental of £2567, were connected with the works, as against 879 houses, &c., producing a rental of £2118, laid on during the six months ended March 31, 1893. On capital account there was an expenditure during the half year of £14,147; making, since the passing of the Metropolis Water Act, 1871, a total outlay on new works, &c., of £864,736. The revenue account shows an increase of £3583 in the water-rents, &c., and of £914 in the expenditure, as compared with the corresponding period of last year. The surplus transferred from the revenue account to the dividend and interest account is £69,224. There is to the credit of the latter account, after payment of interest on the debenture stock, an available balance of £66,449, out of which the Directors recommend the distribution of the maximum dividend at the rate of 7½ per cent. per annum on the shares issued under the Company's Act of 1856, and a dividend at the rate of 9½ per cent. per annum on all the other share capital of the Company. Reference is made to the inquiry by the London County Council as to whether the Directors were willing to enter into negotiations for the sale of the undertaking on the basis indicated in a resolution embodied in their letter. The Directors say that the resolution did not express any fixed basis upon which the suggested negotiations were to proceed; and neither the County Council nor themselves have any power to enter into a binding contract for the transfer of the Company's property. The Directors have considered it necessary to oppose the Thames Conservancy Bill, now before Parliament, with a view to obtaining amendments therein. Besides being open to objections on other grounds, the Bill proposes to largely increase the contribution payable by the Company to the Conservators, while restricting the quantity of water that may be taken from the Thames. The report concludes with a reference to the withdrawal of the London County Council's Water Bill.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO., TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

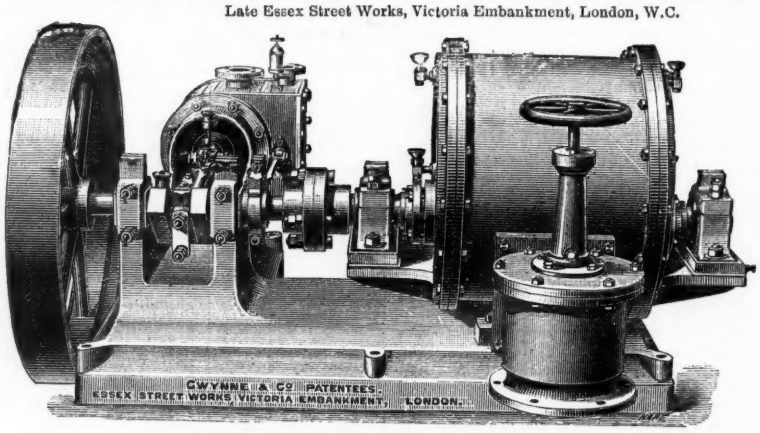
Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.

Late Essex Street Works, Victoria Embankment, London, W.C.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See Advt., p. 875.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegram: "Volcanism, London."

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 993 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

IRISH BOG ORE OXIDE OF IRON.
GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

TAR.

BELGIAN Engineer, having excellent business connections, and able to furnish the highest references, is desirous of undertaking, for a good firm, the Agency for the SALE of TAR in Belgium.
Address No. 2383, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PRACTICAL Plumber, and Gas and Hot Water Fitter, wants constant employment. Well up in Jobbing. Good references.
W. HAYES, 37, Arlington Road, SURBITON.

MANAGER and Chemist of Tar and Ammonia Works is open for an ENGAGEMENT. Highest references.
Address No. 2389, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

YOUNG Man (aged 28), over two years Manager and Secretary of Gas-Works, wishes a change to more central locality. Would take assistantship under a good Engineer. Could be seen at Institute Meetings.
Address No. 2395, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Gas Stoker, or the care of Small Works. Understands Main and Service Laying and Meter Reading. Thirteen years' experience, good reference. Moderate wages.
Apply to F. SELBY, 2, St. Leonard's Road, Colchester, ESSEX.

WANTED, by a Competent Man, a Situation as MAIN and SERVICE LAYER, METER FIXER, INDICE READER, STOVE FIXER, &c. Total abstainer.
Address No. 2393, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by two young Men, an engagement abroad. Ages 26 and 28. Have been employed for the past Five Years in a London Gas-Works (Distribution, Storeage, &c.). Will accept any position of trust. Good reasons for leaving present occupation. Excellent characters.
Address No. 2391, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Draughtsman, Engineer's Assistant, INSPECTOR of WORKS, SUPERIOR FOREMAN, or other capacity, by a thoroughly good Man, well up in every detail, practical, and steady and reliable. First-class experience and character.
Address "ALPHA," 13, Upper Westbourne Villas, Hove, SUSSEX.

WANTED, by respectable Man (age 30) a Situation as STOKER or FITTER in Gas-Works. Thoroughly accustomed to Engines and Exhausters and small repairs about Works, and willing to make himself useful. Wages not so much an object as a permanent job. Total abstainer, and first-class reference.
Address No. 2394, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED (at once), a Manager for Tar Distillery; experienced, and some Engineering and Clerical Knowledge required. Workman's hours. Write, stating experience, age, salary, references, &c., to No. 2396, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Gas Stoker for a Small Works (make 10 millions). Permanent Situation to a steady, industrious Man, who is willing to make himself generally useful. State whether Married or Single, also Wages required.
Address No. 2392, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BROMSGROVE GAS COMPANY.

WANTED, a Man as Smith, Main and Service Layer. One able to fix and take state of Meters, and make himself generally useful. Wages 24s. per week.
Apply, stating age, with references, to
ALFRED BIRD,
Manager.

THE Aberavon Corporation require a MANAGER for their Gas-Works who thoroughly understands the Manufacture and Distribution of Gas. Annual make about 16 millions. Salary £2 2s. per week. None but good Carbonizers need apply.
Applications, stating age and experience and accompanied by copies of not more than three recent testimonials, sealed and endorsed "Manager" must be sent to the undersigned on or before the 9th of June, 1894.
By order,
M. TENNANT,
Town Clerk.
Town Clerk's Office, Aberavon, Port Talbot.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating price per ton and quantity, No. 2390, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

TO INVENTORS AND OTHERS.

PATENTS for Inventions Secured and TRADE MARKS REGISTERED throughout the World. Advice on all matters connected with the above. Handbook gratis on application.
J. C. CHAPMAN, C.E., Chartered Patent Agent, 70, Chancery Lane, LONDON.

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers, BIRMINGHAM, LEEDS, and WAKEFIELD.

GREAT GRIMSBY GAS COMPANY.

TO GAS-ENGINE MAKERS.
LINCOLNSHIRE AGRICULTURAL SHOW
AT GREAT GRIMSBY, JULY, 1894.

THERE will be a good Supply of Gas LAID ON TO THE SHOW GROUND. The present Price is 2s. 4d. per 1000 cubic feet.
WILLIAM DREWERY,
Engineer and Manager.

TOWER Scrubber Wanted (second-hand), having a capacity of 600 or 700 cubic feet.
Price and full Particulars to G. HELPS, HINCKLEY.

WANTED, Four Second-hand Purifiers complete, about 10 feet square.
State Price, with general Dimensions, and whether worked with Centre or Slide Valves, to Mr. JAMES COOK, Town Clerk, ARDROSSAN.

STATION Meter wanted for 12,000 to 15,000 feet per hour. Second-hand one in good condition will not be objected to.
State external dimensions and price delivered f.o.b. at London, Liverpool, or Cardiff. No Valves required.
GEORGE ANDERSON, 35A, Great George Street, WESTMINSTER, S.W.

FOR SALE—One 60 feet Round Station METER. Has only been used a short time.
Apply to the HAPTON CHEMICAL WORKS, near ACCRINGTON.

COUNTY BOROUGH OF BOLTON.
(GAS DEPARTMENT.)

TWO STATION METERS ON SALE.

ON SALE—Two Station Meters, one to pass 40,000 cubic feet of Gas per hour with 16-inch Connections and Valves (made by Braddock, Oldham), the other to pass 45,000 cubic feet per hour, with 16-inch Connections and Valves (made by the Gas-Meter Company, Limited). The Meters are now in use, in good condition, and being removed to make room for Meters of larger capacity.
Further Particulars may be obtained on application to Mr. William Smith, Gas Engineer, Lum Street Gas-Works, Bolton.
Tenders, endorsed "Station Meters," to be addressed to Alderman Miles, Chairman, Gas Committee, Bolton.
R. G. HINNELL,
Town Clerk.
May 23, 1894.

COAL CONTRACT.

THE Directors of the Hexham Gas Company are prepared to receive TENDERS for the supply of about 2400 tons of unscreened GAS COAL, delivered at Hexham Station, as directed, during the Twelve Months ending June 30, 1895.
Tenders, with Analysis of Coal and name of Pit at which it is raised, to be forwarded to the undersigned not later than the 9th of June.
HERBERT LEES,
Secretary and Manager.
Gas-Works, Hexham,
May 16, 1894.

TENDERS FOR GAS COAL.

THE Gas Committee of the Town Commissioners of Newry invite TENDERS for the supply of from 3000 to 3600 tons of GAS COAL, to be delivered in such quantities as may be required by the Committee, and delivered free *ex* Ship or Steamer at Albert Basin, Newry, or f.o.b. at their Shipping Port.
The Coal to be fresh wrought, dry, and free from Clench, Pyrites, or other objectionable matter for Gas Making.
The Committee would assist the Contractor by allowing him to deliver about 1000 tons of Coal prior to the 1st of November next.
Further particulars may be obtained from Mr. A. Gibb, Manager.
Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, and where raised, to be addressed to the Chairman, and delivered to the undersigned not later than Ten a.m., on Friday, the 8th of June next.
The Committee reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.
By order,
R. H. DOHERTY,
Town Clerk.
New Town Hall, Newry,
May 25, 1894.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759
GAS PLANT CEMENT
FOR ALL LEAKAGES.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

PREPAYMENT METER SYSTEM.

COPIES of the Paper read by Mr. G. I. GOUGH, of Calne, at the meeting of the South-West District Association of Gas Managers, at Salisbury, on April 17, 1894, may be had on application to him.
PRICES (post free): Single copies, 6d.; twelve, 1s. 6d.; fifty, 4s. 6d.; one hundred, 8s. (Published by request.)

MESSRS. J. & H. ROBUS are extending and re-constructing Gas-Works in Norfolk, Essex, and Kent. A large portion of the Plant they are removing (although small) is in really first-class condition; and to buyers of Round, Oval, and □ shaped MOUTHPIECES, 4-inch ARCH and DIP PIPES, METERS, and small GOVERNOR, &c. This is an excellent opportunity to purchase second-hand Gas Plant cheap.
20, BUCKLERSBURY, LONDON, E.C.

CROMER, NORFOLK.

TENDERS FOR COAL.

THE Directors of the Cromer Gas and Coke Company, Limited, are prepared to receive TENDERS, from Colliery Proprietors only, for the supply of 800 tons of First-class GAS COAL, to be delivered at (*a*) the Great Eastern Railway Station, or (*b*) the Eastern and Midlands Railway Station, Cromer, between the 1st day of June next, and the 31st day of May, 1895. Weight given to be stated.
Deliveries to be made in such quantities and at such times as may be required by the Company.
Payment, net cash monthly.
Sealed tenders, endorsed "Tender for Coal," to be sent to the undersigned, on or before Monday, the 4th of June next.
The Directors do not bind themselves to accept the lowest or any tender.
By order,
P. E. HANSELL,
Secretary.
Cromer, May 21, 1894.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Gas Committee invite Tenders for the purchase of the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at their Works, for a period of One, Two, or Three Years, commencing on July 1, 1894.
Particulars as to quantity and Conditions of Contract may be obtained on application to the Engineer, Mr. S. Meunier, Millgate, Stockport.
Tenders, endorsed with the subject of tender, addressed to the Chairman of the Gas Committee, must be sent in on or before June 6, 1894.
The Committee do not bind themselves to accept the highest or any tender.
By order,
WALTER HYDE,
Town Clerk.
May 25, 1894.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TENDERS FOR STORES.

THE Gas Committee are prepared to receive TENDERS for the supply of the following MATERIALS from July 1, 1894, to June 30, 1895, viz.—

1. Bolts and Nuts.
2. Brushes.
3. Brass and Meter Fittings.
4. Cartage.
5. Casting.
6. Drysaltery.
7. Retorts and Fire Goods
8. Glass, Red and White Lead.
9. Iron and Steel.
10. Ironmongery.
11. Lead Pipe, Tin.
12. Mill Furnishing.
13. Oils and Tallow.
14. Purifier-Grids.
15. Ropes and Flax.
16. Shovels, Pick-Heads.
17. Timber, English and Foreign.
18. Tubing.
19. Wet and Dry Meters.
20. Stationery.
21. Lime.

Forms of Tender and all further Information may be obtained on application to the Engineer, Mr. S. Meunier, Millgate, Stockport. No Form of Tender other than that issued by the Committee will be accepted.
Tenders, endorsed "Contract 1, 2, &c.," as the case may be, addressed to the Chairman of the Gas Committee, Stockport, to be sent in on or before Wednesday, June 6, 1894.
No tender will be accepted without satisfactory proof that the firm tendering pays the standard rate of wages and observes the standard number of hours.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
WALTER HYDE,
Town Clerk.
May 25, 1894.

BOROUGH OF WARRINGTON.

(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for the supply of 15,000 tons of COAL and 2000 tons of CANNEL.

Further Particulars and Form of Tender can be obtained on application to Mr. W. S. Haddock, Engineer, Gas-Works.

Sealed tenders, endorsed, and addressed to the Chairman of the Gas Committee, Gas Offices, must be sent in by Ten a.m. on Friday, the 8th prox.

FREDK. TAYLOR.

Gas Offices, Warrington,
May 25, 1894.

CLEATOR MOOR LOCAL BOARD.

(GAS DEPARTMENT.)

THE above Board invite Tenders for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works from July 1, 1894, to June 30, 1895.

Endorsed tenders must be delivered to the undersigned on or before Tuesday, June 5, 1894.

The Board do not bind themselves to accept the highest or any tender.

By order,
HENRY ROTHERY,
Clerk to the Board.

Public Offices, Cleator Moor,
May 26, 1894.

COUNTY BOROUGH OF HUDDERSFIELD.

GAS COAL.

THE Gas Committee are prepared to receive TENDERS, from Colliery Proprietors only, for the supply and delivery of from 40,000 to 60,000 tons of GAS COAL.

Form of Tender and full Particulars may be obtained on application to Mr. W. R. Herring, Engineer, Gas-Works, Huddersfield. Sealed tenders, endorsed "Tender for Coal," to be addressed and sent to him not later than Thursday, the 7th of June, 1894.

By order,
H. BARBER,
Town Clerk.

Huddersfield, May 23, 1894.

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the supply of about 15,000 tons of CANNEL and about 300,000 tons of best GAS COALS (screened or nuts). Price per ton to be quoted, delivered at their Gas-Works, Meadow Lane (Hunslet Lane Siding), New Wortley (Gelderd Junction Siding), or at the Gas-Works, York Street, in such quantities as may be required. The contract to commence the 1st of July next, and terminate the 30th of June, 1895.

Forms of Tender may be obtained on application to Mr. Lupton, General Superintendent, Gas Department, Municipal Offices, Calverley Street.

Tenders may be for any portion of the total quantity required, and will be received not later than Wednesday, the 20th of June next, addressed to the Chairman of the Gas Committee, Municipal Offices, Calverley Street, and endorsed "Tender for Coal."

The lowest or any tender will not necessarily be accepted.

May 26, 1894.

TENDERS FOR COAL.

THE above Company will be glad to receive TENDERS for 800 tons (more or less) of well-screened GAS COAL, free from Bats, Bind, Pyrites, or any other Impurities, and delivered free, at the Wirksworth (Midland) Railway Station, in such quantities as the Manager may from time to time require during the Twelve Months from date of Contract.

Sealed tenders, endorsed "Tender for Coal," to be sent to R. Wall, Esq., Chairman, on or before June 13, 1894.

Those tendering will please say where such coal is being used, and send working analysis to the Manager.

TENDERS FOR TAR.

The above will also be glad to receive TENDERS for TAR for Twelve Months, dating from and after May 1, 1894.

Sealed tenders, endorsed "Tender for Tar," to be sent to R. Wall, Esq., Chairman, on or before June 13, 1894.

(Signed) JAMES LEE,
Secretary and Manager.

HALIFAX CORPORATION GAS-WORKS.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of

WROUGHT-IRON TUBES,
CAST-IRON PIPES,
LIME,
SULPHURIC ACID,
OXIDE OF IRON;

also for the purchase of SPENT OXIDE OF IRON.

The contracts will be for a period of Twelve Months commencing the 1st of July next.

Full Particulars and Forms of Tender may be obtained on application to Mr. Thomas Holgate, F.C.S., Gas-Works, Halifax.

Tenders, properly endorsed, must be sent to the undersigned before Ten o'clock a.m. on the 8th of June 1894.

The tender of any person paying less than the minimum standard rate of wages, and who does not observe the hours and conditions of labour generally recognized in the district, will not be accepted. This condition shall be construed to the acts of Sub-Contractors where such may exist

The Committee do not bind themselves to accept the lowest, highest, or any tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

THE INCORPORATED

Gas Institute.

THE THIRTY-FIRST

ANNUAL GENERAL MEETING

OF THE MEMBERS

WILL BE HELD ON

Tuesday, Wednesday, and Thursday,

the 19th, 20th, and 21st June, 1894,

AT THE

WESTMINSTER TOWN HALL,

LONDON, S.W.

THE CHAIR WILL BE TAKEN BY THE PRESIDENT,

JOHN WEST, ESQ., M.Inst. C.E.

On Friday there will be a Trip to Oxford, viewing the Colleges and Chapels, and, after Luncheon, a Steamer Trip to Nuneham. Full particulars will be announced on the Programme.

THE BENEVOLENT FUND.

The Annual General Meeting of the Donors and Subscribers to the Benevolent Fund will be held on Tuesday, June 19, at 5 o'clock p.m.

FREDK. G. BURFIELD, Secretary.

13, Victoria Street, Westminster, S.W.

PONTYPRIDD LOCAL BOARD (GAS).

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of the whole or part of 5000 tons "through and through" GAS COAL for the Year ending June 30, 1895.

Conditions and Forms of Tender may be obtained on application to Mr. H. Barker, Manager.

Tenders, sealed and endorsed "Tender for Gas Coal," to be sent to the undersigned not later than Twelve o'clock Noon on Monday, June 11, 1894.

The Committee do not bind themselves to accept the lowest or any tender.

HENRY LL. GROVER,
Clerk to the Board.

ISLE OF THANET GAS COMPANY.

SULPHATE OF AMMONIA.

THE Directors of the above Company are prepared to receive TENDERS for about 30 tons of SULPHATE OF AMMONIA for delivery, f.o.b. Margate, on or about the 15th of June next.

Tenders, addressed to the Chairman of the Company, to be received not later than the 7th of June.

Payment to be made on basis of sample before delivery.

For Samples and further Particulars, apply to the Manager, Mr. H.H. Jones.

The Directors do not bind themselves to accept the highest or any tender.

By order,
T. C. FULLER,
Secretary.

Gas-Works, Margate,
May 25, 1894.

BOROUGH OF DEWSBURY.

THE Lighting and Water Committee are prepared to receive TENDERS for the supply and delivery of 6000 tons of the best screened GAS COAL (required to complete existing Contracts), for the Year ending the 30th of June, 1895.

Tenders must specify prices for delivery by Road, or by Water, or by Rail, and be made on Forms to be had on application to Mr. Charles A. Craven, Engineer and Manager, Savile Town Gas-Works, Dewsbury, from whom any further Information can be obtained.

Sealed tenders, endorsed "Tender for Gas Coal," to be sent to me not later than Saturday, the 2nd of June next.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
E. MAWDESLEY,
Town Clerk.

Town Clerk's Office, Town Hall, Dewsbury,
May 25, 1894.

COMMERCIAL GAS COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the supply of 180,000 tons of clean, dry, unscreened, fresh-wrought GAS COALS, delivered f.o.b. to the Company's Steamers at any suitable Port, during the Year ending the 31st of July, 1895.

The deliveries to be in equal monthly quantities throughout the Year.

Payment in cash monthly.

Parties desiring to tender for more than One Year must state separately the price and quantity offered for each Year.

Particulars and Forms of Contract may be obtained from the Engineer, Mr. H. E. Jones.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders, sealed and endorsed "Tender for Coals," to be addressed to the Chairman of the Coal Committee, and delivered at the Company's Offices not later than Twelve o'clock on the 20th of June, 1894.

Commercial Gas-Works, Stepney, E.,
May 24, 1894.

BOROUGH OF CONGLETON.

THE Gas Committee invite Tenders for the supply of 2500 tons of best screened GAS COAL, 2500 tons of BURGY, and 300 tons of best screened CANNEL, to be delivered between the 1st of July, 1894, and the 30th of June, 1895.

Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Coal," addressed to the Chairman of the Gas Committee, to be delivered at the Town Clerk's Office, not later than Wednesday, June 6.

WILLIAM T. GOODWIN,
Manager.

TAR AND LIQUOR.

THE Gas Committee of the Borough of Congleton are prepared to receive TENDERS for their surplus TAR and AMMONIACAL LIQUOR, to be produced at their Gas-Works from July 1, 1894, to June 30, 1895.

Further Particulars may be obtained from the undersigned.

Sealed tenders, endorsed "Tar and Liquor," addressed to the Chairman of the Gas Committee, to be delivered at the Town Clerk's Office, not later than Wednesday, June 6.

WILLIAM T. GOODWIN,
Manager.

BOROUGH OF BRIGHOUSE.

THE Mayor, Aldermen, and Burgesses of the Borough of Brighouse, acting by the Council, are prepared to receive TENDERS for the supply of the following STORES—viz., FIRE-CLAY GOODS, IRONMONGERY, BRASS MAIN-COCKS, New WET GAS-METERS, New DRY GAS-METERS, OIL PAINTS, &c., STEEL GOODS, WROUGHT-IRON TUBES and FITTINGS, WROUGHT-IRON GOODS, and BRUSHES, required by the Gas Committee during the Year ending March 25, 1895.

Specification and Form of Tender can be obtained on application at the Gas Engineer's Office, Public Offices, Brighouse.

Sealed tenders are to be sent in on or before Monday June 11, 1894, addressed to the Town Clerk, Public Offices, Brighouse.

The lowest or any tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Public Offices, Brighouse,
May 25, 1894.

UFFCULME GAS COMPANY, LIMITED.

THE Directors of the Uffculme Gas Company, Limited, invite TENDERS for the purchase of their FREEHOLD PREMISES, together with the whole of the PLANT, MACHINERY, and STOCK IN TRADE, with the GOODWILL as a going Concern, and including the GOODWILL and STOCK IN TRADE of the Business of COAL MERCHANTS also carried on by the Company.

The Purchaser will also have the option of taking off the Book Debts.

To view, apply to the Secretary, Mr. John Thorn, Uffculme, Cullompton; and for further Particulars apply to the Secretary or to the undersigned Solicitor, at whose Offices the Conditions of Sale may be seen.

Sealed tenders should be sent not later than the 19th day of June, 1894, to the Secretary or to the undersigned.

The Directors do not bind themselves to accept the lowest or any tender.

E. LEE MICHELL,
Solicitor.

Wellington, Somerset,
May 24, 1894.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Corporation of Birkenhead are pre- pared to receive TENDERS for the supply of COAL, COAL NUTS, CANNEL, and CANNEL NUTS, for Gas-making purposes, for a period of One, Two, or Three Years, commencing from the 25th of June, 1894.

Forms of Tender, together with any further Information, may be obtained from Mr. T. O. Paterson, C.E., Gas Engineer, Gas-Works, Birkenhead.

Tenders (accompanied by copy of analysis), stating the price per ton, delivered on to the Gas-Works Railway Siding, must be sent in to me, sealed and endorsed "Tender for Gas-Works Coal," not later than Five o'clock in the Afternoon of Friday, the 8th of June, 1894.

Also for a supply of STEAM COAL and SLACK, to be delivered at the Pumping-Stations of the Spring Hill, Playbrick Hill, and Borough Road Water-Works, for a period of One, Two, or Three Years, commencing from the 25th of June, 1894.

Deliveries to be made from time to time according to the requirements of the respective Engineers.

Forms of Tender, together with any further Information, may be obtained from Mr. W. A. Richardson, C.E., Water Engineer, Town Hall, Birkenhead.

Tenders, stating the price per ton delivered at the various Pumping-Stations, must be sent in to me sealed and endorsed "Tender for Water-Works Coal," not later than Five o'clock in the Afternoon of Friday, the 8th of June, 1894.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
May 28, 1894.

SALE OF NEWPORT (MON.) GAS SHARES.

(UNDER THE PROVISIONS OF THE COMPANY'S ACT, 1886.)

MESSRS. PARSONS AND ROBJENT have received Instructions from the Directors to SELL BY PUBLIC AUCTION, at the King's Head Hotel, Newport, Mon., on Wednesday, the 13th day of June, 1894, at Three o'clock in the Afternoon,

SIXTY CLASS "C" SHARES OF £100,

in Lots of one Share each.

The Statutory Dividend is 7 Per Cent. per Annum.

Particulars and Conditions may be had on application to the AUCTIONEERS, Central Chambers, NEWPORT; or to EDWARD F. MARFLEET, Secretary, at the Offices of the Company, NEWPORT, MON.

Dated May 4, 1894.

COLWYN BAY AND DISTRICT GAS AND LIGHTING COMPANY, LIMITED.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 1000 or 1200 tons of GAS COAL, for One Year, from July 1 next, to be delivered at Colwyn Bay Station, carriage paid, as required.

Sealed tenders, endorsed "Tender for Gas Coal," specifying the description and quality of the Coal, to be addressed to the Secretary, Public Hall, Colwyn Bay, and delivered not later than Monday, June 25, 1894.

SCARBOROUGH GAS COMPANY.

THE Directors of the Scarborough Gas Company invite TENDERS for the surplus TAR and the whole of the AMMONIACAL LIQUOR produced at their Works, for One Year from the 1st of July next.

Tenders for Liquor may be submitted either at a fixed price per ton or on a sliding scale, regulated by the price of Sulphate. Preference will, however, be given to the latter.

Further Particulars may be obtained on application to the undersigned, to whom tenders (properly endorsed) must be delivered not later than Noon, on Tuesday, the 12th day of June next.

(Signed) J. HOLLIDAY,
Secretary and General Manager.

FALKIRK JOINT-STOCK GAS COMPANY LIMITED.

TENDERS FOR COAL AND LIME.

THE Falkirk Joint-Stock Gas Company, Limited, invite TENDERS for COAL and LIME.

Estimated quantity 6500 tons of Splint or Cannel, 200 tons of Shale, and 400 tons of Lime Shells, delivered, as required, at Dalderse Siding, Grahamston.

The Directors do not bind themselves to accept the lowest or any tender, and reserve the right to divide the contracts.

Sealed tenders, with analysis of Coal offered, to be sent in not later than Thursday, the 31st of May, 1894, addressed to the Manager, Gas-Works, Falkirk, and marked "Tender for Coal" or "Lime," as the case may be.

TENDERS FOR COAL.

THE Directors of the Town of Dudley Gaslight Company are prepared to receive TENDERS for the supply of 5000 to 12,000 tons of GAS COAL, to be delivered at the London and North-Western Railway or Great Western Railway Sidings, Dudley, in such quantities as may be required from the 1st of July, 1894, to the 30th of June, 1895.

Sealed tenders, addressed to the Chairman, and endorsed "Tender for Coal," to be sent in not later than the 8th of June.

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to divide the contract between two or more firms.

By order,
T. E. STILLARD,
Secretary.

Gas-Works, Dudley,
May 16, 1894.

CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are prepared to receive TENDERS for the supply of about 16,000 tons of screened or unscreened GAS COAL, and about 4000 tons of CANNEL, to be delivered at their Works in Carlisle in such quantities as may be directed, from the 1st of July next.

Tenders, specifying the description of the Coal or Cannel, the Pits at which they are to be raised, and the terms for the net monthly payment, are to be sent on or before June 5, 1894, endorsed "Tender for Coal."

Forms of Tender to be had from

J. HEPWORTH,
Engineer.

Gas-Works, Carlisle,
May 23, 1894.

CITY OF CARLISLE.

TAR CONTRACT.

THE Carlisle Gas Committee are prepared to receive TENDERS for the SURPLUS TAR to be produced at their Works, for a period of one or more Years from the 30th of June next.

Any further Particulars required can be obtained upon application to the Engineer, to whom sealed tenders, endorsed "Tender for Tar," must be delivered on or before June 5, 1894.

The Committee do not bind themselves to accept the highest or any tender.

J. HEPWORTH,
Engineer.

Gas-Works, Carlisle,
May 23, 1894.

SLIGO GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the Sligo Gas Company invite TENDERS for the supply of 2000 tons of large screened GAS COAL.

Payments: Net Cash one month after delivery.

The Coal is to be supplied in 300 to 400 ton lots as required during the Twelve Months commencing Aug. 1, 1894.

Tenders to quote delivery on Quay at Sligo (Cost, Freight, and Insurance included), also f.o.b. at Port of shipment.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders to be sent to the Chairman on or before June 18, 1894, endorsed "Tender for Gas Coal."

C. B. TULLY,
Engineer and Secretary.

Gas-Works, Sligo,
May 22, 1894.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gaslight Company invite TENDERS for the supply of about 12,000 tons of screened GAS COALS, and about 1000 tons of good ENGLISH CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Year commencing July 1, 1894, and ending June 30, 1895.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any tender.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 22nd day of June, 1894.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 22, 1894.

DEVONPORT GAS AND COKE COMPANY.

TENDERS FOR GAS COALS.

THE Directors of the Devonport Gas and Coke Company invite TENDERS for the supply of 14,000 tons or 7000 tons (at their option) of unscreened (through and through) NEWCASTLE or DURHAM GAS COALS, to be shipped in such quantities, and at such times as may be required, between the 1st of August, 1894, and the 31st of July, 1895.

The Cargoes to be discharged at the Tamar Wharf, Devonport.

Tenders may be quoted, either c.i.f. or f.o.b., endorsed "Tender for Coals," addressed to the Chairman, Devonport Gas and Coke Company, Devonport.

Tenders to be sent in on or before Monday, the 4th of June next.

JOHN WILLIAMS,
Secretary.

Devonport,
May 23, 1894.

TO MANUFACTURING CHEMISTS.

TAR AND AMMONIA WATER.

THE Directors of the Loughborough Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIA WATER, to be produced at their Works for One Year, from the 30th day of June.

The estimated quantities will be about 350 tons of Tar, and 900 tons of Ammonia Water. The Tar and Liquor to be delivered into the Contractor's Boats at the Wharf, on the Derby Road, Loughborough.

The strength of the Liquor to be tested by Twaddel's Hydrometer (temperature 60°); and the tender to state the price per ton of 4° rising ½° up to 8°.

The boats for the removal of the Tar and Liquor to be sent at such times as may be required. Payments 10th of following month.

Further Information may be obtained on application to the undersigned, to whom tenders, in accordance with this advertisement, must be sent not later than the 9th day of June.

The Directors do not bind themselves to accept the highest or any tender.

J. B. BALL, C.E.,
Manager.

Loughborough, May 26, 1894.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 20,000 tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the Company's Engineer, Mr. R. Morland.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than Monday, the 11th day of June next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 10, 1894.

CROYDON COMMERCIAL GAS AND COKE COMPANY.

SALE, BY TENDER, OF 500 ORDINARY SHARES OF £10 EACH,

Being a portion of the Additional Capital Authorized to be raised under the Powers of the Croydon Gas Act, 1877.

MINIMUM PRICE, £22 PER SHARE.

THE Directors give notice that they will be prepared to receive, not later than Eleven o'clock on the Morning of Wednesday, the 6th of June, 1894, sealed TENDERS for 500 ORDINARY SHARES of £10 each, to be paid up in full on or before the 30th of June, 1894, and to bear Dividend from that date.

The last Dividend paid upon this class of Shares was at the rate of 11 per cent. per Annum.

One £10 Share, or any number of the 500 Shares, can be tendered for.

Printed Particulars and Conditions of Sale, and Form of Tender, may be obtained at the Offices of the Company, Katharine Street, Croydon.

WILLIAM J. RUSSELL,
Secretary.

May 2, 1894.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1½ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-ON-TYNE.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 21, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road,

CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—		
Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER

LOW MOOR BLACK BED

GAS COAL.

YIELD OF GAS PER TON · 10,375 CUBIC FEET.
ILLUMINATING POWER · 17·50 SPERM CANDLES.
COKE. . . . . 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,

RAVENS LODGE AND CONYERS' COLLIERIES,

DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS TOOLS GENERALLY.

London Office:

80, CANNON STREET, E.C.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

Lanemark Coal Co.,

LIMITED.

LANEMARK CANNEL AND GAS COALS.

Quotations and Analysis on application to

LANEMARK COLLIERY,

NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

TELL-TALES.

A first-class Manufactory in Baden (Black Forest) wishes to extend the manufacture of

TELL-TALES FOR GAS-METERS,

and requests interested parties to send their addresses to S., 1448, c/o

HAASENSTEIN AND VOGLER, A-G,

KARLSRUHE, GERMANY.

THE DRUM

FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.

See Advertisement in last and next issue.

T. B. KITTEL, SHEFFIELD.

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Water	0·020
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Analysis of the Coke.

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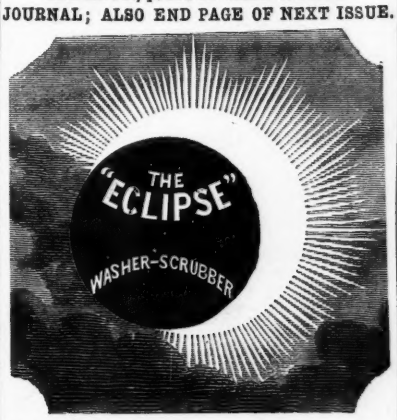

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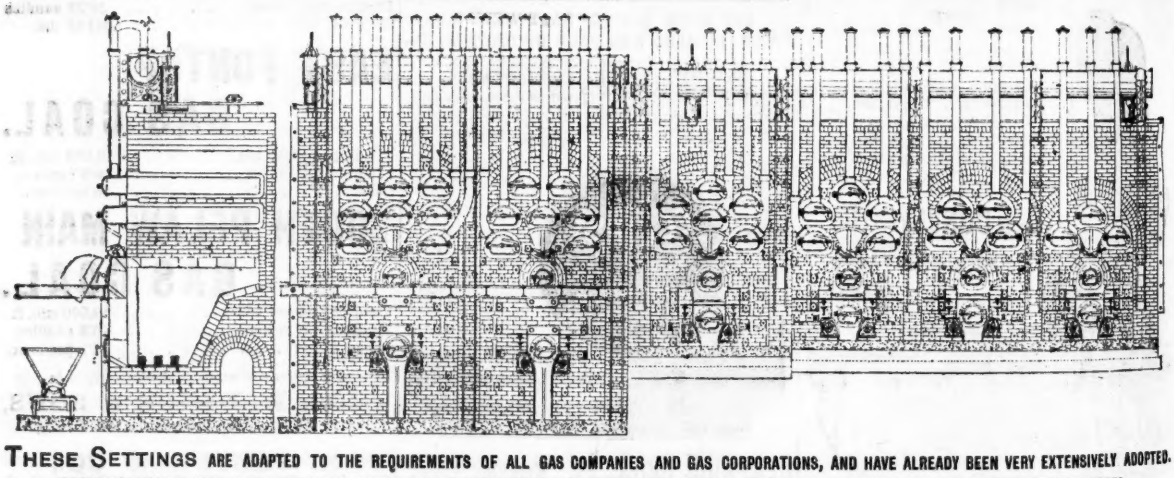

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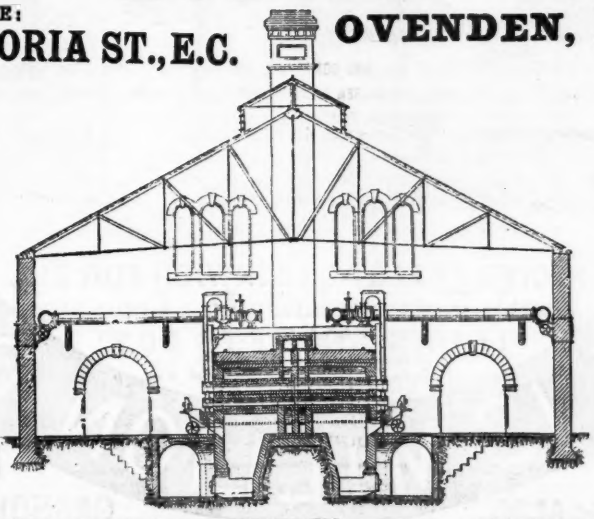

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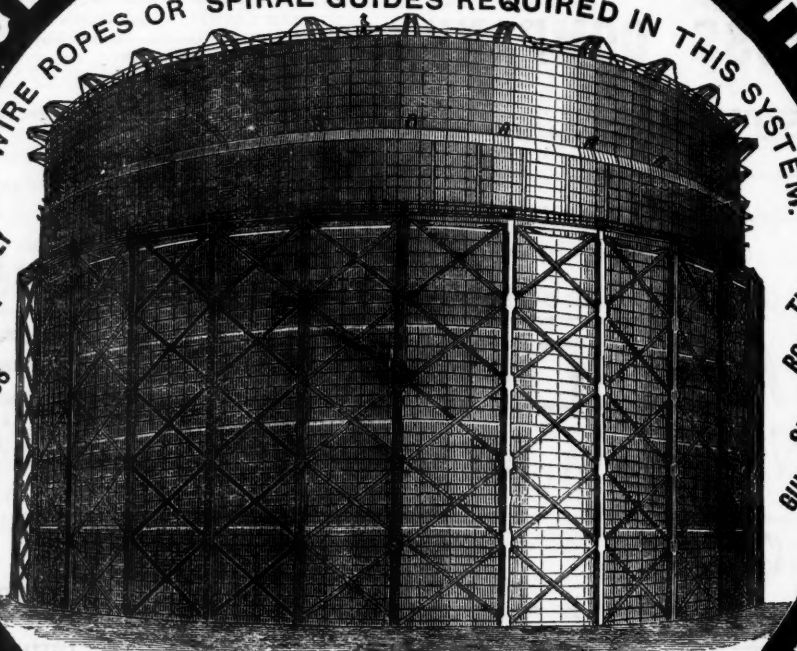

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